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Safety User Manual

(Series Version, Certification outstanding)

DS230, DS236, DS240, DS246

Safety Monitor for Speed, Standstill and Direction of Rotation (SIL3, PLe)

DS230:	Monitor with 2 SinCos- and 2 RS422 Inputs, Analog Output and Signal Splitter
DS236:	Monitor with 2 SinCos- and 2 RS422 Inputs and Analog Output
DS240:	Monitor with SIL3 SinCos Input, Analog Output and Signal Splitter
DS246:	Monitor with SIL3 SinCos Input and Analog Output

- SIL3 and PLe certification
- Safety functions equivalent to EN61800-5-2 (SS1, SS2, SOS, SLS, SDI, SSM)
- Two differential inputs each for SinCos and incremental encoders
- Two inverse redundant HTL / PNP inputs for encoders, proximity switches or control commands
- Forced guided redundant output relay (NO) and four inverse redundant HTL control outputs
- Safety related analog output (4 to 20 mA)
- Easy and safe integration into existing sensor wirings, enabled by the integrated signal splitter
- Mounting on standard DIN rails (35 mm C-profile)
- Easy Parameterization via USB interface and Operator Surface OS6.0 or pluggable display- and programming-unit (optional)

Version:	Description:
Ds23001a_oi_e.doc/mb/07/14	First Edition
Ds23001b_oi_e.doc/pp/02/15	Operational modes supplemented
Ds23001c_ oi_e.doc/mb/02/15	Installation procedure supplemented
Ds23001d_ oi_e.doc/ag/02/15	Spelling corrections and optical modifications
Ds23001e_ oi_e.doc/ag/03/15	Diverse corrections and updates
Ds23001f_ oi_e.doc/sn/04/15	Diverse corrections and updates

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1. Safety Instructions and Responsibility

1.1. General Safety Instructions

This operation manual is a significant component of the unit and includes important rules and hints about the installation, function and usage. Non-observance can result in damage and/or impairment of the functions to the unit or the machine or even in injury to persons using the equipment!

Please read the following instructions carefully before operating the device and observe all safety and warning instructions! Keep the manual for later use.

A pertinent qualification of the respective staff is a fundamental requirement in order to use these manual. The unit must be installed, connected and put into operation by a qualified electrician.

Liability exclusion: The manufacturer is not liable for personal injury and/or damage to property and for consequential damage, due to incorrect handling, installation and operation. Further claims, due to errors in the operation manual as well as misinterpretations are excluded from liability.

In addition the manufacturer reserves the right to modify the hardware, software or operation manual at any time and without prior notice. Therefore, there might be minor differences between the unit and the descriptions in operation manual.

The raiser respectively positioner is exclusively responsible for the safety of the system and equipment where the unit will be integrated.

During installation or maintenance all general and also all country- and application-specific safety rules and standards must be observed.

If the device is used in processes, where a failure or faulty operation could damage the system or injure persons, appropriate precautions to avoid such consequences must be taken.

1.2. Use according to the intended purpose

The unit is intended exclusively for use in industrial machines, constructions and systems. Non-conforming usage does not correspond to the provisions and lies within the sole responsibility of the user. The manufacturer is not liable for damages which are arisen through unsuitable and improper use. Please note that device may only be installed in proper form and used in a technically perfect condition (in accordance to the Technical Specifications). The device is not suitable for operation in explosion-proof areas or areas which are excluded by the EN 61010-1 standard.

1.3. Installation

The device is only allowed to be installed and operated within the permissible temperature range. Please ensure adequate ventilation and avoid all direct contact between the device and hot or aggressive gases and liquids.

Before installation or maintenance, the unit must be disconnected from all voltage-sources. Further it must be ensured that no danger can arise by touching the disconnected voltage-sources.

Devices which are supplied by AC-voltages, must be connected exclusively by switches, respectively circuit-breakers with the low voltage network. The switch or circuit-breaker must be placed as near as possible to the device and further indicated as separator.

Incoming as well as outgoing wires and wires for extra low voltages (ELV) must be separated from dangerous electrical cables (SELV circuits) by using double resp. increased isolation.

All selected wires and isolations must be conforming to the provided voltage- and temperature-ranges. Further all country- and application-specific standards, which are relevant for structure, form and quality of the wires, must be ensured. Indications about the permissible wire cross-sections for wiring are described in the Technical Specifications.

Before first start-up it must be ensured that all connections and wires are firmly seated and secured in the screw terminals. All (inclusively unused) terminals must be fastened by turning the relevant screws clockwise up to the stop.

Overvoltage at the connections must be limited to values in accordance to the overvoltage category II.

For placement, wiring, environmental conditions as well as shielding and earthing/grounding of the supply lines the general standards of industrial automation industry and the specific shielding instructions of the manufacturer are valid. Please find all respective hints and rules on www.motrona.com/download.html --> [General EMC Rules for Wiring, Screening and Earthing].

1.4. Cleaning, Maintenance and Service Notes

To clean the front of the unit please use only a slightly damp (not wet!), soft cloth. For the rear no cleaning is necessary. For an unscheduled, individual cleaning of the rear the maintenance staff or assembler is self-responsible.

During normal operation no maintenance is necessary. In case of unexpected problems, failures or malfunctions the device must be shipped for back to the manufacturer for checking, adjustment or reparation. Unauthorised opening and repairing can have negative effects or failures to the protection-measures of the unit.

2. Introduction

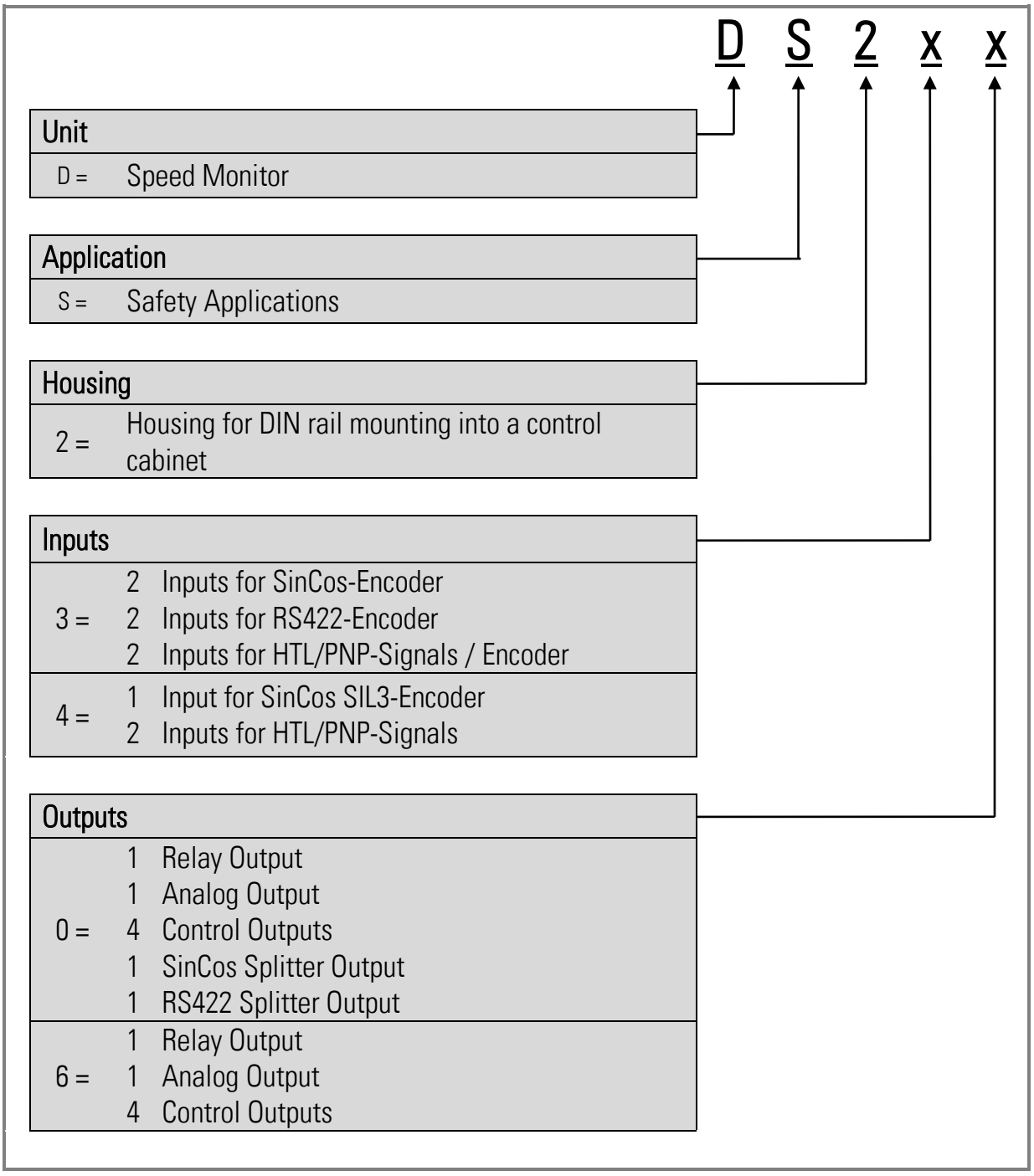
This series of speed monitors is suitable for safety-related monitor like over-speed, under-speed, standstill and direction of rotation. This SIL3/PLe certified generation of devices was developed to achieve functional safety by supporting a wide range of sensors in different combinations. Due to its innovative multifunctional inputs these devices are perfectly suitable for the retrofitting of plants and machines by using the existing “non safe“ sensors. This offers a great opportunity to save costs for expensive and certified sensors. Also the costs for new installations and adjustments can be reduced significantly by using the existing components and wiring.

Typical examples are centrifuges, cranes, wind power or hauling plants.

Special features:

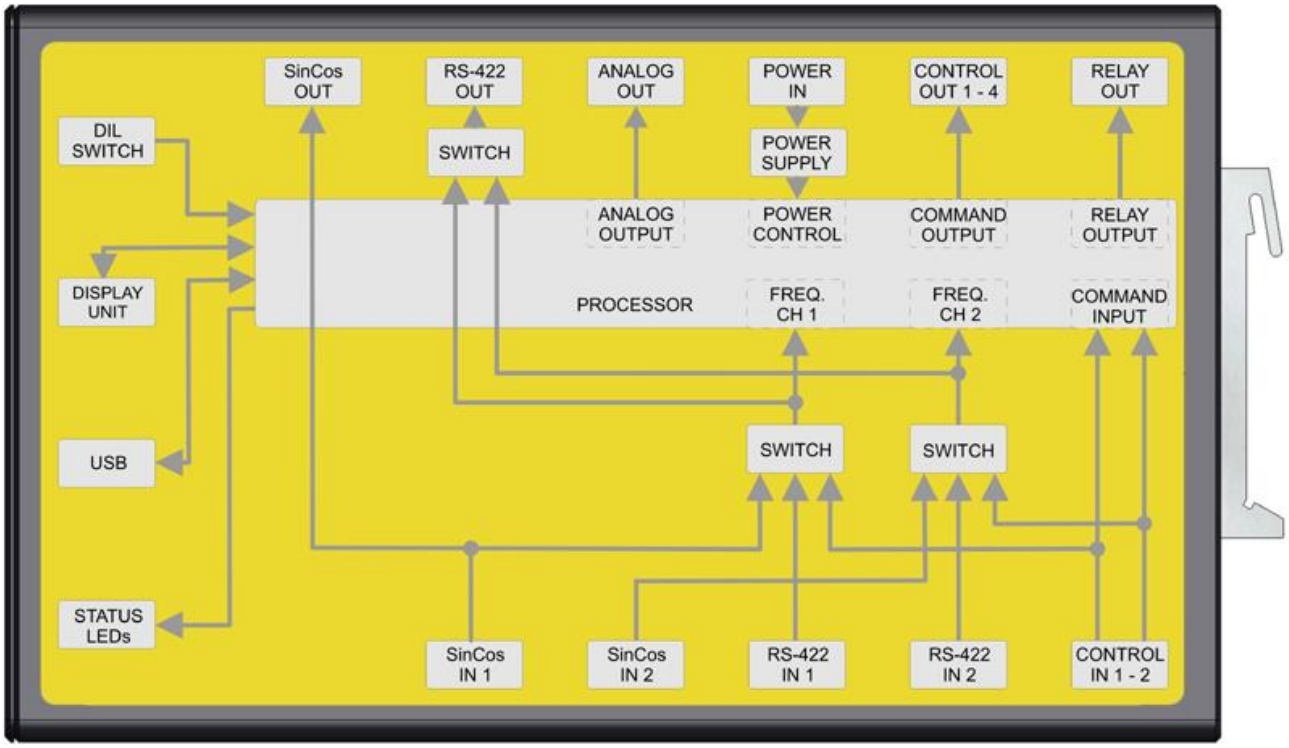
- Suitable for a "Set-up mode",
  e. g. for manual settings at plants with open doors and reduced speed
- The units come with dual certification according to EN 61508, EN 62061 / SIL 3 and EN ISO 13849-1 Cat. 3 / PL e, even by using “non safe“ sensors
- Wide range of the input frequency and fast response time
- Easy scaling of the two sensor frequencies to get the best performance
- Easy setup by PC via USB or by the optionally available programming module BG230

3. Available Models

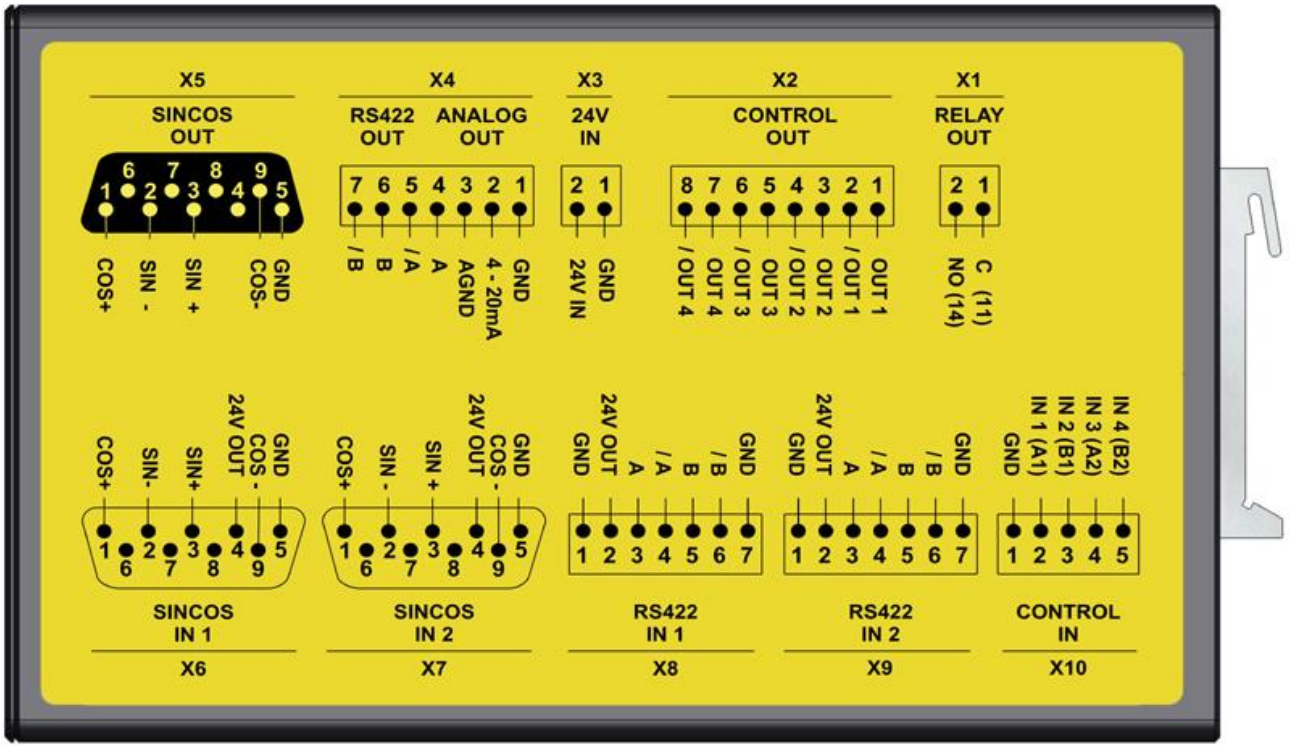


4. Block Diagrams and Connections

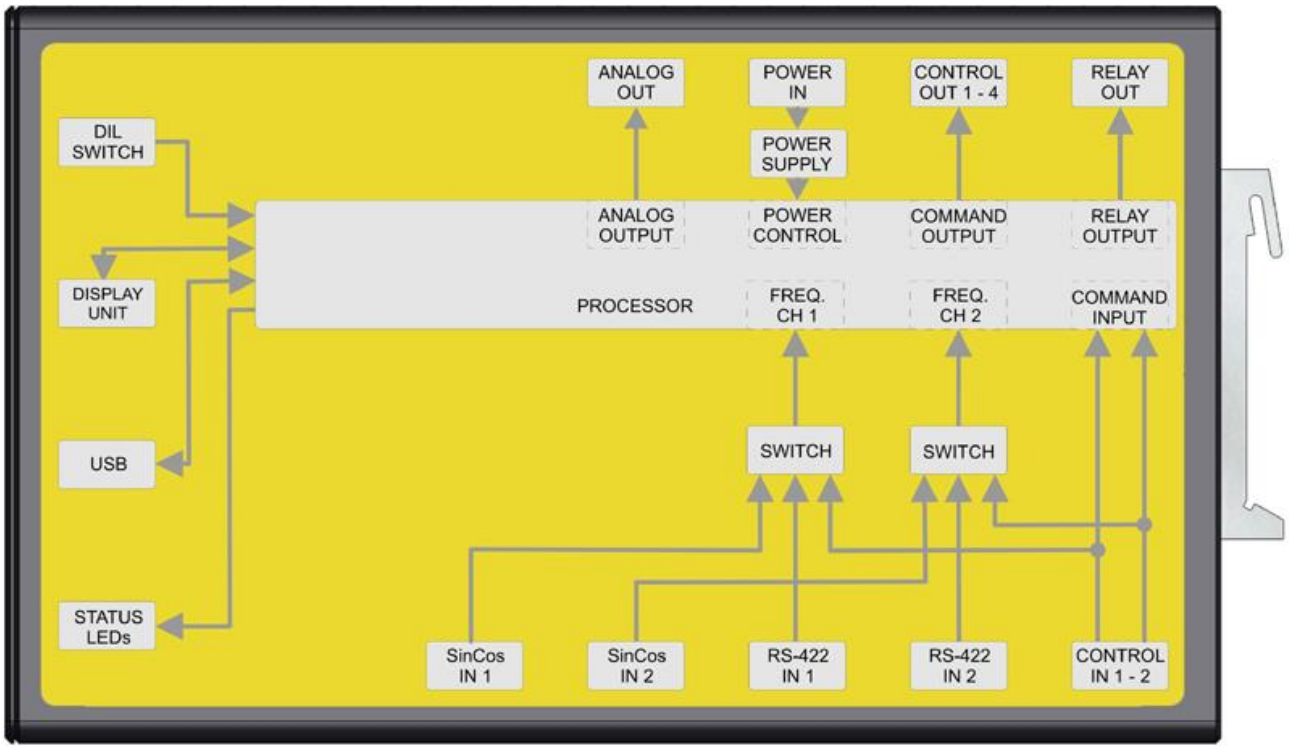
4.1. DS230 Block Diagram



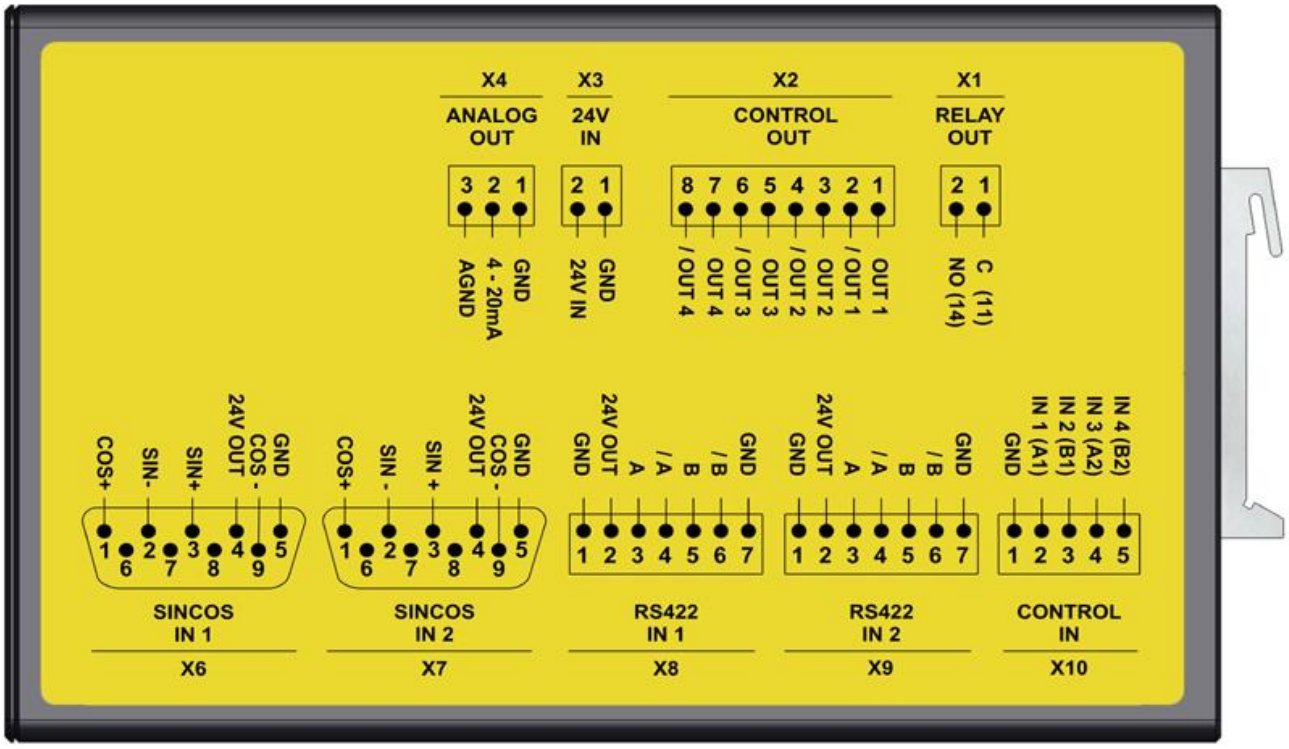
4.2. DS230 Connections



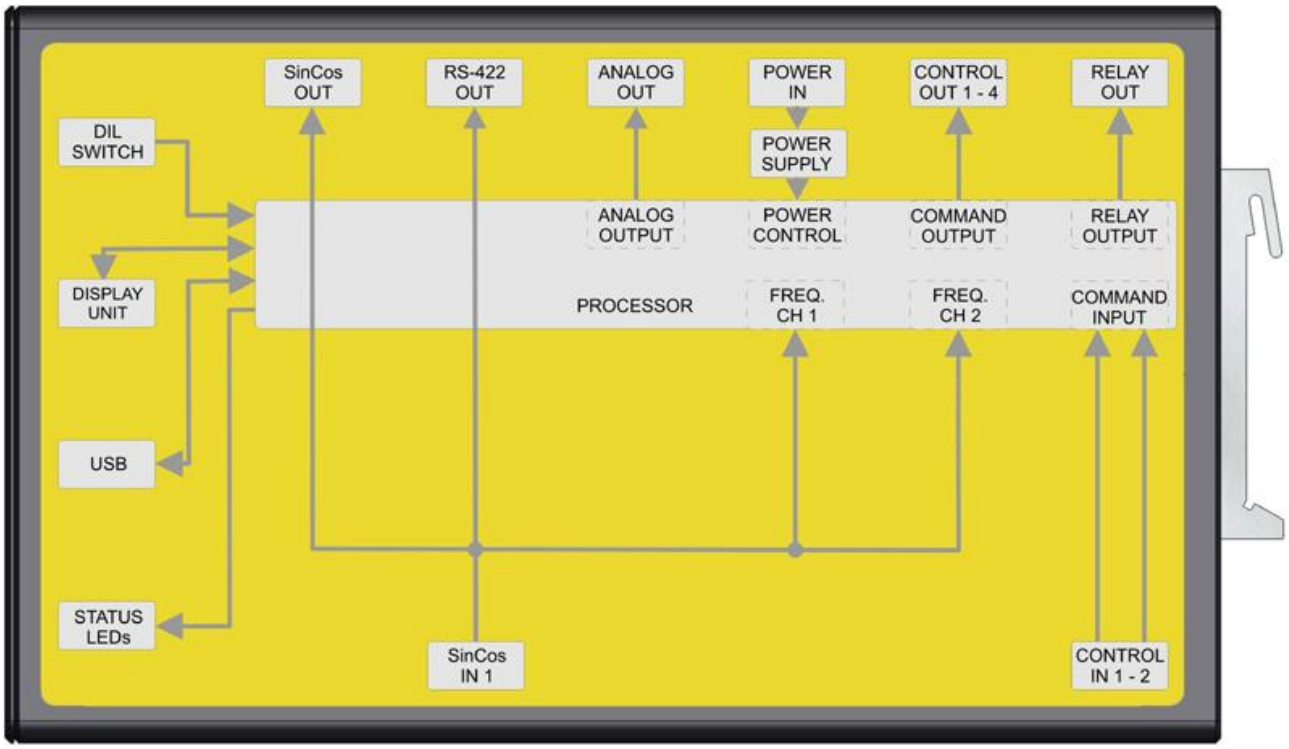
4.3. DS236 Block Diagram



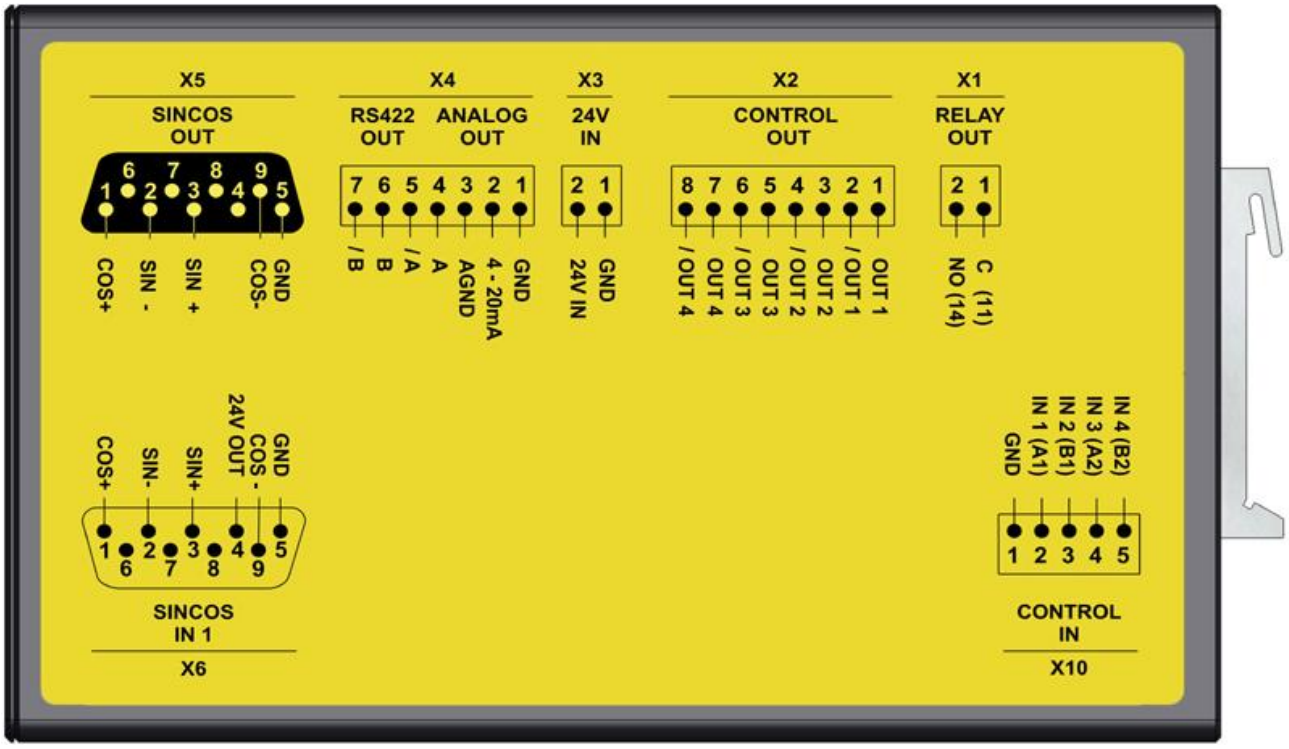
4.4. DS236 Connections



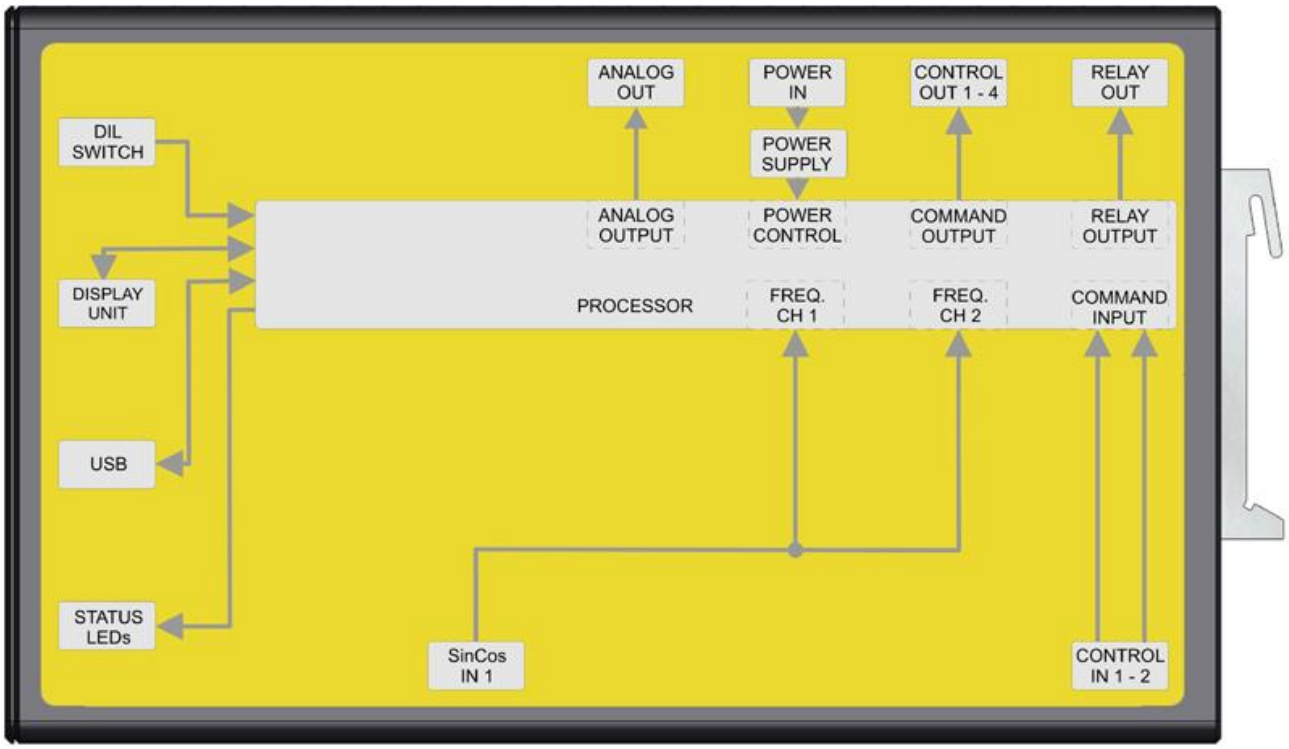
4.5. DS240 Block Diagram



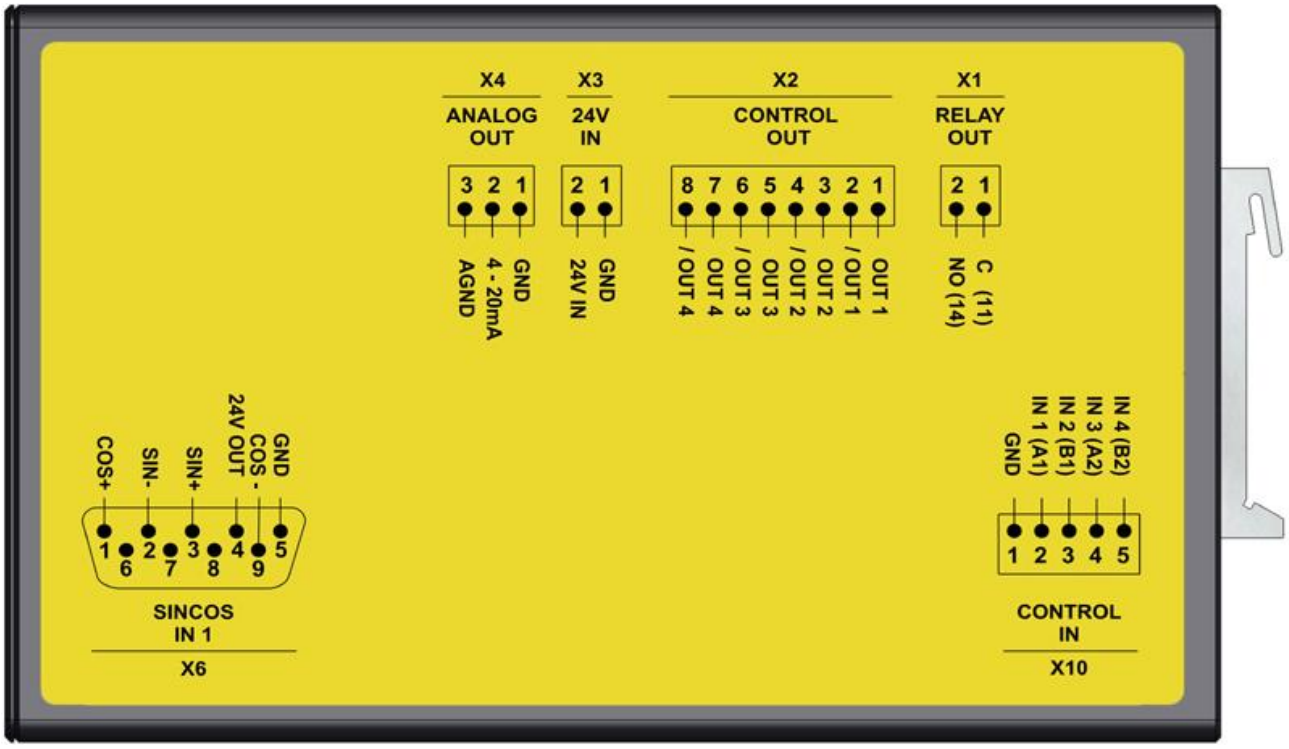
4.6. DS240 Connections



4.7. DS246 Block Diagram



4.8. DS246 Connections



5. Description of Connections

This chapter describes only the electrical connections and their general function. For the detailed technical information's please refer the chapter 13.

Name	Description see chapter
X1 | RELAY OUT	5.10 Relay-Output
X2 | CONTROL OUT	5.9 Control-Outputs
X3 | 24V IN	5.1 Power Supply
X4 | ANALOG OUT	5.8 Analog-Output 4 to 20 mA
X4 | RS 422 OUT	5.7 RS422-Splitter-Output
X5 | SINCOS OUT	5.6 SinCos-Splitter-Output
X6 | SINCOS IN 1	5.3 SinCos-Inputs
X7 | SINCOS IN 2	5.3 SinCos-Inputs
X8 | RS422 IN 1	5.4 RS422-Inputs
X9 | RS422 IN 2	5.4 RS422-Inputs
X10 | CONTROL IN	5.5 Control-Inputs
X11	5.12 Interface for Display Unit BG230
X12	5.13 Interface for the Operator Surface OS6.0
S1	5.11 DIL-Switch
ERROR - ON	5.14 LEDs / Status Indication

- All outputs perform safe. The connection to the outputs is only safe if the downstream device detects the fault status of each output.

5.1. Power Supply

If the unit is connected to a DC power supply network, which supplies further devices or systems, it must be ensured that no voltages ≥ 60 V can occur at the terminals X3:1 and X3:2.

If this cannot be ensured, the unit must be supplied by a separate DC power pack, which may not be connected to further devices or systems.

The requirements for both kinds of power supply are:

- Nominal voltage range from 18 … 30 VDC
- Ripple < 10% @ 24 V
- External fuse (2.5 A, medium time lag) required

A separate power pack must cover the following requirements:

- The switch-on current of the unit is maximum 2.5 A
- The consumption of the unit is maximum 45 W

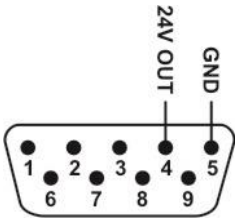
The 18 … 30 VDC power supply must be connected by the pluggable 2-pin screw terminal [X3].
The power supply input is protected by an internal reverse polarity protection.

pluggable 2-pin screw terminal [X3]

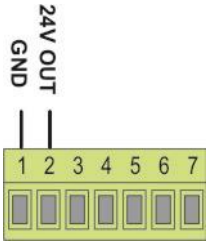
- The input must be protected by an external fuse (type and value see chapter 13. "Technical Specifications").
- A SIL3 certified power supply can be used without any further external components or protections.

5.2. Encoder Supply

The unit offers an auxiliary voltage output to power the used encoder resp. sensors.
The power supply of the encoders must be carried out directly from the safety unit (see chapter 5.2.1) or in use of an external power supply via a relay (see chapter 5.2.2).



Encoder supply: SinCos inputs [X6] [X7]



Encoder supply: RS422 inputs [X8] [X9]
HTL encoders or sensors must also be connected to the encoder supply of the RS422 inputs

The maximum load of encoder supply is 200 mA each channel (Sensor1 and Sensor2).

Supply	SinCos inputs	RS422 inputs	HTL inputs
Sensor1	[X6:4] [X6:5]	[X8:1] [X8:2]	[X8:1] [X8:2]
Sensor2	[X7:4] [X7:5]	[X9:1] [X9:2]	[X9:1] [X9:2]

When powering up the encoder supply, the maximum input current of the safety unit can be exceeded due to different encoders. In this case, the encoder supply will not be enabled and an error appears (see chapter 10).

In case of such problems or if another voltage level is required, the encoder supply can be switched by an external voltage source via a relay. The relay activation must be performed by the encoder supply of safety unit (see chapter 5.2.2).

- In case of a direct encoder supply it is mandatory to operate the encoders with the auxiliary voltage from the unit.
- An external encoder supply must be done in each case via a relay which is triggered by the auxiliary voltage of the unit.

5.2.1. Direct Encoder Supply

The unit provides an auxiliary encoder supply for each sensor channel
(HTL encoders must be supplied by the encoder supply for the RS422 inputs).

The level of the supply voltage is approximate 2 V below the 18 … 30 VDC power supply at terminal [X3].

The maximum load of encoder supply is 200 mA each channel (Sensor1 and Sensor2).

Supply	SinCos inputs	RS422 inputs	HTL inputs
Sensor1	[X6:4] [X6:5]	[X8:1] [X8:2]	[X8:1] [X8:2]
Sensor2	[X7:4] [X7:5]	[X9:1] [X9:2]	[X9:1] [X9:2]

Example of a direct encoder supply

- In case of a direct encoder supply it is mandatory to operate the encoders with the auxiliary voltage from the unit.

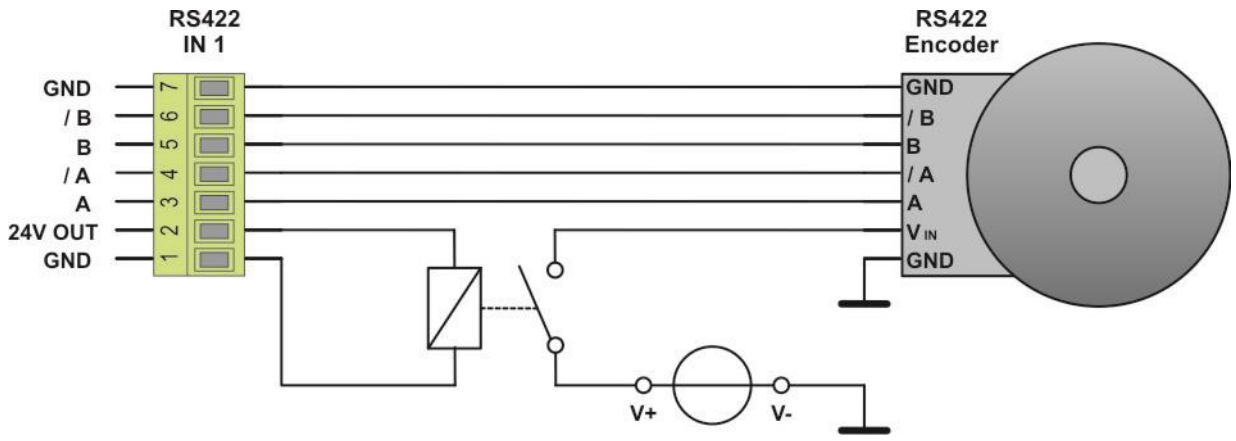
5.2.2. External Encoder Supply

An external encoder supply must be done in each case via a relay which is triggered by the auxiliary voltage of the unit.

This is necessary, because the encoder supply will only be available after initialization and self-test of the unit.

The operator must ensure that the plant cannot reach a safety-critical state, in case of a failure of the relay or a failure of the external encoder voltage (switched by the relay).

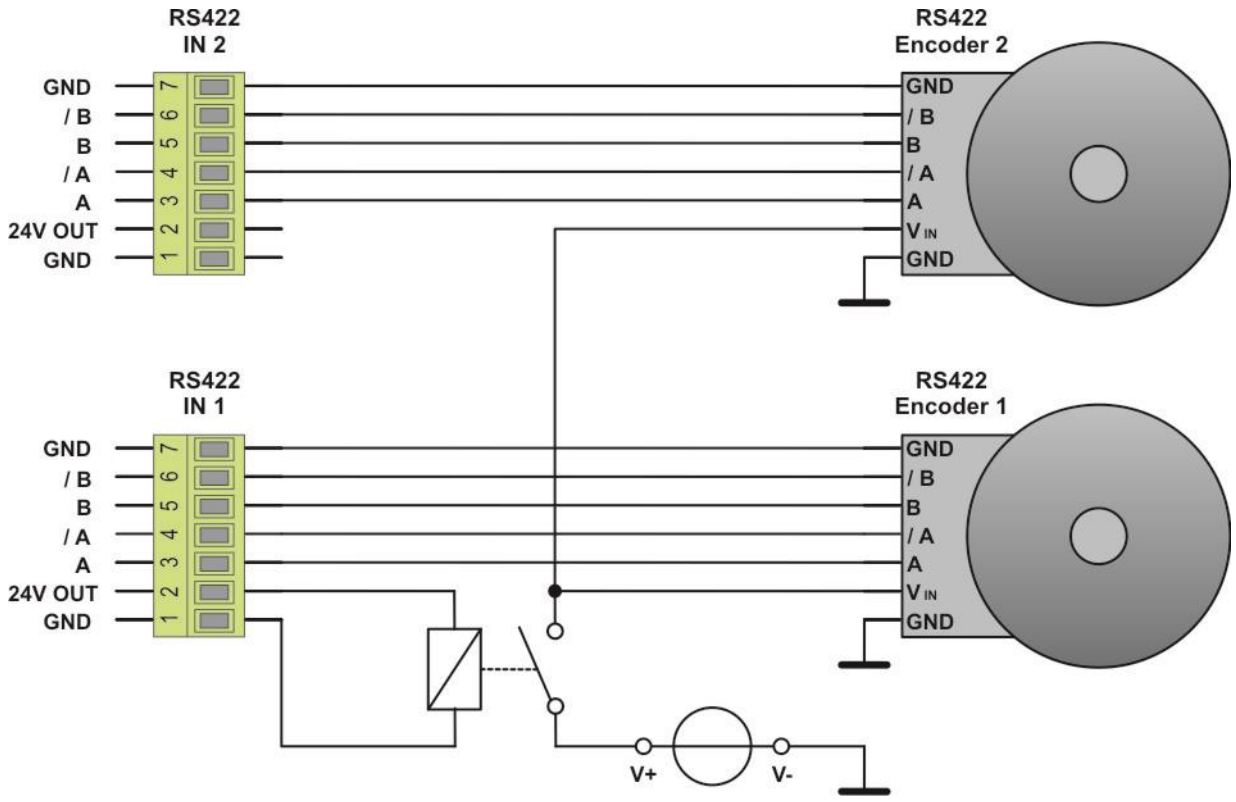
Explanation / Solution:
In case of failure of the external encoder supply the encoder would "rotate", but the unit would not detect speed or speed differences. To detect this error the operator can use e. g. a control output of the unit which indicates "standstill" (see Section 8.4.5). A master controller has to compare the two states (plant "rotate" and control output "standstill"). If the two states differ the master controller has to trigger an error and the plant has to go to a safe state.



Example of an external encoder supply (1 encoder is switched via 1 relay)

- An external encoder supply must be done in each case via a relay which is triggered by the auxiliary voltage of the unit.
- The operator must ensure that the plant cannot reach a safety-critical state, in case of a failure of the relay or a failure of the external encoder voltage (switched by the relay).

External Encoder Supply



Example of an external encoder supply (2 encoders are switched via 1 relay)

- An external encoder supply must be done in each case via a relay which is triggered by the auxiliary voltage of the unit.
- The operator must ensure that the plant cannot reach a safety-critical state, in case of a failure of the relay or a failure of the external encoder voltage (switched by the relay).

5.3. SinCos-Inputs

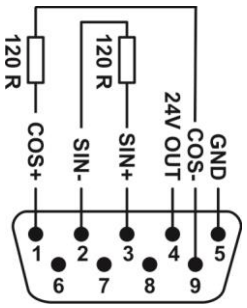
If the operational mode is set for using SinCos encoders (see chapter 8.4.1 / parameter 000), the unit will accept SinCos input signals with 1 Vpp and 2.5 V DC-offset at the 9-pin SUB-D connectors [X6] and [X7].

It is mandatory to connect up always all existing signal lines (SIN+, SIN-, COS+ and COS-). The internal SinCos encoder signal monitor verifies the common mode range of each signal line and is able to detect cable fractures.

An evaluation option for any existing reference signals (REF+ and REF-) is not applicable.

All input lines are already terminated by internal 120 Ohm load resistors.

The SinCos encoder must use the corresponding encoder supply at pin 4 and pin 5 of the connector (see chapter 5.2).



male SUB-D connector [X6], [X7]

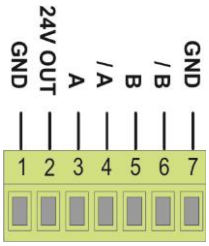
5.4. RS422-Inputs

(Only DS230 and DS236)

If the operational mode (see chapter 8.4.1 / Parameter 000) is set for RS422 encoder use, the unit will accept differential input signals from an incremental encoder in RS422 format at the terminal strips [X8] and [X9]. The traces of the RS422 input (A and /A resp. B and /B) are wired internally with a dynamic terminating (220 pF / 120 ohm).

It is mandatory to connect up all signal lines (A, /A, B and /B). An evaluation of the reference signals (Z and /Z) is not applicable and therefore no connection terminals are available.

The RS422 encoder must use the corresponding encoder supply at terminal 1 and terminal 2 of the connector (see chapter 5.2).



pluggable 7-pin screw terminal [X8], [X9]

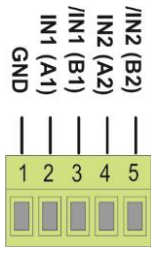
5.5. Control-Inputs

The screw terminal [X10] has two inputs for signals with HTL level and PNP switching characteristic. Each of the inputs performs complementary.

Depending on the operational mode (see chapter 8.4.1 / parameter 000), the Control-Inputs can be configured as frequency- or command inputs:

- **Frequency input for HTL encoders (A / B / 90°):**
  Sensor1 = IN1 (A1) and /IN1 (B1)
  Sensor2 = IN2 (A2) and /IN2 (B2)
  HTL encoders must be supplied by the encoder supply of the RS422 inputs (chapter 5.2.).
- **Frequency input for HTL encoders (A) or a proximity switch:**
  Sensor1 = IN1 (A1)
  Sensor2 = IN2 (A2)
  e. g. to evaluate a gear wheel by connecting a proximity switch
  The inputs /IN1 (B1) and /IN2 (B2) can be left open (internal pull-down) or can be used for a static preset of direction of rotation
  HTL encoders must be supplied by the encoder supply of the RS422 inputs (chapter 5.2.).
- **Command input for HTL commands:**
  Input 1: IN1 and /IN1
  Input 2: IN2 and /IN2
  The following stats of signals are allowed:
  "LOW": The direct input low and the inverted input high (HTL level).
  "HIGH": The direct input high (HTL level) and the inverted input low.
  Any other conditions will be interpreted as an error by the unit.

  For further more information regarding the command inputs see chapter 8.4.6.



pluggable 5-pin screw terminal [X10]

- It does not make sense, to configure the device for a connection of 2 HTL encoders simultaneously, because then no more inputs for commands will be available.
- With DS24x units, the HTL/PNP inputs can only be used as control-inputs for external commands.

5.6. SinCos-Splitter-Output

(Only DS230 and DS240)

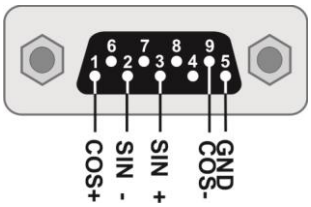
The integrated splitter exports the signal existing at input SinCos IN1 [X6] to the female 9-pin SUB-D connector [X5]. Thus the encoder signal which is connected to SinCos IN1 can be processed by a further target device.

The signal delay time between SinCos input and SinCos output is approximately 200 ns.

The channels SIN+ and SIN- resp. COS+ and COS- must be terminated by 120 Ohm load resistors at the target device.

In case of an error, the DC-offset of the SinCos output is shifted in order to signalize the error condition to the target device.

The connection to the SinCos splitter output is only safe, if the following device includes a SinCos monitoring system and can detect the offset error.



female SUB-D Connector [X5]

- The channels SIN+ and SIN- resp. COS+ and COS- must be terminated by 120 Ohm load resistors at the target device.

5.7. RS422-Splitter-Output

(Only in DS230 and DS240)

Depending on the version of the unit and the selected operating mode, the integrated splitter function allows to export an input frequency to the output terminal X4 | RS422 OUT. Thereby the RS422 signal can be processed by a further device. An overview offers the block diagrams (see chapter 4).

DS230:

The device evaluates two frequency channels. Which input is assigned to which channel is set in the operating mode (see chapter 8.4.1 / Parameter 000). The splitter output allows exporting the input frequency from one of these channels (see chapter 8.4.8).

DS240:

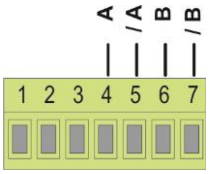
Only the input frequency of the encoder connected at X6 | SINCOS IN 1 can be exported to the RS422 Splitter output.

If a SinCos encoder is connected to the selected input, the output-signal at X4 | RS422 OUT is a square wave signal which is converted by the unit.

The signal delay time between RS422 input and RS422 output is approximately 600 ns.

In case of an error, no more incremental signals are available at the RS-422 output (Tri-State with pull-down cut off).

The connection to the RS422 Splitter output is only safe if the following device can detect the error state of the safety unit.



pluggable 7-pin screw terminal [X4]

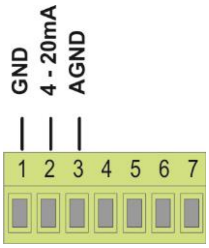
- With DS230 and DS240 variants, the screw terminal [X4] has 7 pins. These are used to put out the RS-422 pulses (pin 1 - 4) and also the analog signal (pin 1 - 3).
- With DS236 and DS246 variants, the screw terminal [X4] has only 3 pins, which are exclusively used to put out the analog signal.

5.8. Analog-Output 4 to 20 mA

One analog output is available at the screw terminal [4]. The safety-related current output is freely scalable (see chapter 8.4.9). It delivers an output signal, which is proportional to one of the input frequency (see chapter 8.4.1 / Parameter 003) and independent from the connected input sensor-types.

During normal operation, the output moves in a proportional range from 4 to 20 mA.
In case of errors, the analog output is 0 mA. Then the operator is responsible to ensure safety conditions to all system-parts and -components which are influenced by the analog output.

In case of an unused analog output, Pin 2 and 3 of the X4 terminal must be linked. An open analog output (e.g. wire fracture) will release an error status.



pluggable 7-pin screw terminal [X4]

- With DS230 and DS240 variants, the screw terminal [X4] has 7 pins. These are used to put out the RS-422 pulses (pin 1 - 4) and also the analog signal (pin 1 - 3).
- With DS236 and DS246 variants, the screw terminal [X4] has only 3 pins, which are exclusively used to put out the analog signal.

5.9. Control-Outputs

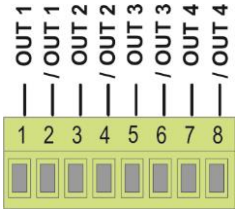
Four HTL control outputs are available at the screw terminal [X2].
Each of the output performs complementary (OUT1, /OUT1 to OUT4, /OUT4).

The switching conditions and behaviour are adjustable by parameters (see chapter 8.4.4and 8.4.5)

During HIGH state, the output level is about 2 V below the supply voltage which is connected to terminal [X3]. Each output has a push-pull output stage and short circuit protection.

When switching inductive loads, additional external suppression measures are recommended.

In case of errors all outputs are LOW (no more inversion between OutX and /OutX)



pluggable 8-pin screw terminal [X2]

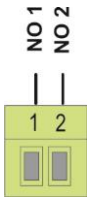
5.10. Relay-Output

The safety-related relay-output consists of two independent relays with force guided contacts. The normally open contacts of the two relays (NO) are internally connected in series. At the 2-pin screw terminal [X1] the series-relay-contact can be tapped for integration into a safety circuit.

The contacts are only closed during normal and disturbance-free operation. They will open to its safety state in case of errors or when the programmed switching condition (see chapter 8.4.4) is fulfilled. In a de-energized state of the unit, the contacts are also open.

The switching conditions and behaviour of the relay-output are freely programmable by parameters. Further the shutter is integrated within all monitoring functions.

In case of an error, the contact changes to its open and safety condition.

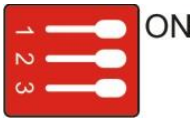


pluggable 2-pin screw terminal [X1]

- In case of an open relay-contact, the operator is responsible to ensure a safety state to all relevant parts and components of the equipment.
- The target unit must be able to evaluate edges, in order to determine dynamical conditions of the relay output too.
- At frequencies close to the switching point, relay bouncing may occur through the variance of the frequency measurement. To prevent this effect, a hysteresis should be set (Parameter 053).
- If short oversteps of the switching point should be detected, a lock output should be set (Parameter 057)

5.11. DIL-Switch

The 3-position DIL-switch is located at the front of the unit
(only accessible, if no display-unit is connected).



3-pos DIL-switch [S1]

The following unit-states can be selected by the DIL-switch:

Slider	Condition	Unit-State
1	ON	„Normal Operation“ - parameter access disabled
	OFF	„Factory Settings“ - with next power-on, all parameters will be reset to default values
2	ON	„Normal Operation“ - parameter access disabled
	OFF	„Self Test Message“ - with next power-on, the unit will transmit a self test protocol via USB interface (without “Self Test Message” booting of the start up is faster)
3	ON	„Normal Operation“ - parameter access disabled
	OFF	„Programming Mode“ – allows access to the parameters (by display unit or PC)

- „Programming Mode“ only for start-up
- Set all DIL-switch sliders to „ON“ after start-up
- Protect the DIL-switch sliders after start-up
  (e. g. by covering with an adhesive tape)
- Normal operation is only permitted when the yellow LED is permanently off

5.12. Interface for Display Unit BG230

The serial interface serves for communication between the unit and an optional programming- and display unit „BG320“, which can be plugged on the front.

8-pin female connector [X11]

The connection between the programming- and display unit BG230 and the safety unit take place by the female 8-pin connector [X11] at the front-side.

5.13. Interface for the Operator Surface OS6.0

- Within the pre-series the USB port is not active.
- By using the accessory part CK232 and AKDS230 the DS230 can be programmed through the 8-pole connector [X11].

For communication between the unit and a PC or a super ordinate controller, a serial interface simulation is accessible at the USB port. For connection a standard USB-cable with a „Type B“ connector is used.

USB type B

Before using the USB interface the USB driver “motrona_vcom.inf” has to be stored to your computer. This driver could be downloaded from the support area of the motrona web page.

5.14. LEDs / Status Indication

Two status LEDs are located at the front of the unit. The green one is marked as [ON] and the yellow one as [ERROR].

Status LEDs

The following conditions are used with the green status LED:

LED (green)	Condition
OFF	Power off - no power supply voltage
ON	Power on - power supply voltage is ok

The following conditions are used with the yellow status LED:

LED (yellow)	Condition
OFF	Normal operation, self-test successfully completed, no error messages
ON	After power on: the unit is running up, self-test in progress
	During normal operation: error released by the process (divergence of frequencies etc.)
SLOW	DIL1 = OFF: unit-state „Factory Settings“
	DIL3 = OFF: unit-state „Programming Mode“
FAST	Error: incorrect self-test or internal error (see chapter 10. Error Handling)

OFF = LED if off
ON = LED is lighting
SLOW = slow flashing (approx. 1 Hz)
FAST = fast flashing (approx. 2.5 Hz)

- „Programming Mode“ only for start-up
- Set all DIL-switch sliders to „ON“ after start-up
- Protect the DIL-switch sliders after start-up
  (e. g. by covering with an adhesive tape)
- Normal operation is only permitted when the yellow LED is permanently off

6. Operational Modes of DS230 - DS236

6.1. Operational Mode Overview

Mode	Sensor1	Sensor2
0	SinCos encoder (SIN+, SIN-, COS+ and COS-)	SinCos encoder (SIN+, SIN-, COS+ and COS-)
1	SinCos encoder (SIN+, SIN-, COS+ and COS-)	Incremental encoder HTL (A and B)
2	SinCos encoder (SIN+, SIN-, COS+ and COS-)	Incremental encoder HTL (A) or proximity switch
3	Incremental encoder HTL (A and B)	Incremental encoder HTL (A and B)
4	Incremental encoder HTL (A and B)	Incremental encoder HTL (A) or proximity switch
5	Incremental encoder HTL (A) or proximity switch	Incremental encoder HTL (A) or Proximity switch
6	SinCos encoder (SIN+, SIN-, COS+ and COS-)	Incremental encoder RS422 / TTL (A, /A, B and /B)
7	Incremental encoder RS422 / TTL (A, /A, B and /B)	Incremental encoder RS422 / TTL (A, /A, B and /B)
8	Incremental encoder RS422 / TTL (A, /A, B and /B)	Incremental encoder HTL (A and B)
9	Incremental encoder RS422 / TTL (A, /A, B and /B)	Incremental encoder HTL (A) or proximity switch

The operational modes can be specified in the Main Menu (see chapter 8.4.1 / Parameter 000).

6.2. Achievable Safety Levels of diverse Operational Modes

Mode	Sensor1	Sensor2	Function	Achievable Safety Level
0	SIN+, SIN-, COS+, COS-	SIN+, SIN-, COS+, COS-	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe
1	SIN+, SIN-, COS+, COS-	HTL A, B	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe
2	SIN+, SIN-, COS+, COS-	HTL A or proximity switch	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe **** SIL3 / PLe ****
3	HTL A,B	HTL A, B	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe
4	HTL A,B	HTL A or proximity switch	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe **** SIL3 / PLe ****
5	HTL A or proximity switch	HTL A or proximity switch	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe **** SIL3 / PLe ****
6	SIN+, SIN-, COS+, COS-	RS422 / TTL A, /A, B /B	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe
7	RS422 / TTL A, /A, B /B	RS422 / TTL A, /A, B /B	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe
8	RS422 / TTL A, /A, B /B	HTL A, B	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe
9	RS422 / TTL A, /A, B /B	HTL A or proximity switch	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe **** SIL3 / PLe ****

**** The safety level can only be achieved, if it is physically ensured, that there only can be a rotary or linear movement into one direction. This can be realized for example by using a self-locking gearbox.

To achieve a maximum of SIL3/PLe on system-level, no certificated sensors are required for the fulfilment of the integration of the device. When using standard sensors, only the required safety level (by complying the safety-related characteristics SFF, HFT, Type A/B, PFH, PFD resp. category, DCavg and MTTFd) and systematic safety integrity must be ensured for overall protection circuit. Software programs (like SISTEMA) are very helpful for creating such evaluations of safety-related machine control systems according to the EN ISO 13849 norm.

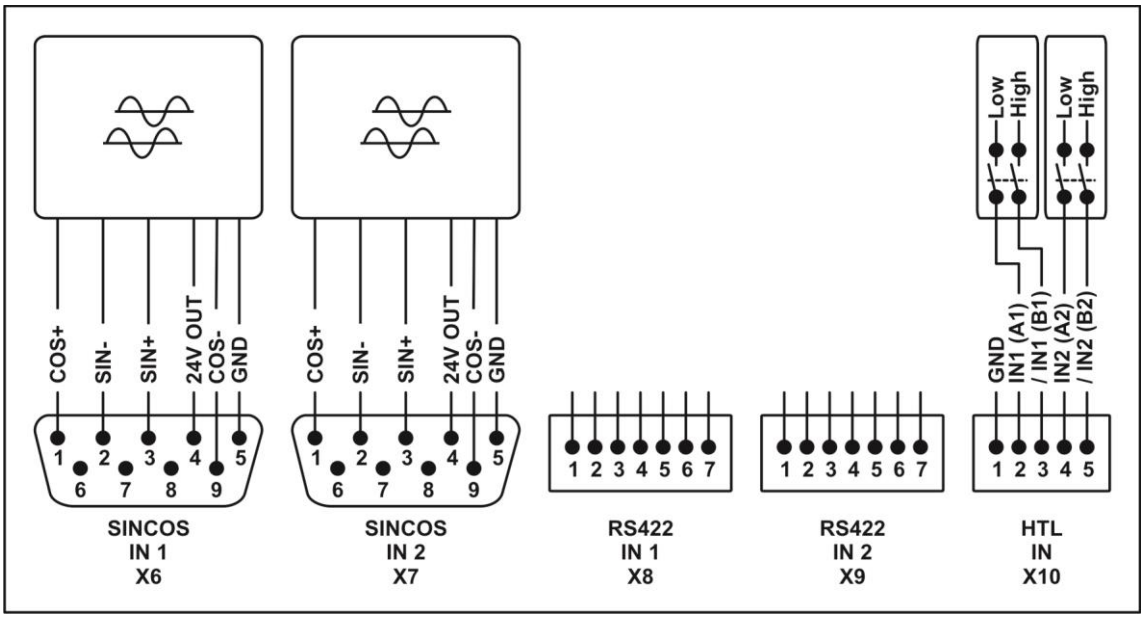
6.3. Operational Mode = 0

Mode	Sensor1	Sensor2
0	SinCos encoder (SIN+, SIN-, COS+ and COS-)	SinCos encoder (SIN+, SIN-, COS+ and COS-)

This mode is used to evaluate a dual channel system, equipped with two SinCos sensors resp. Encoders, which must be performed in accordance to chapter 0.

The following connections are processed in this mode:

Mode	Sensor1	Sensor2	Command IN1	Command IN2
0	SinCos 1 [X6]	SinCos 2 [X7]	available	available



- In case of a DS230 with an integrated encoder-splitter it must be ensured, that only SinCos input 1 (terminal X6) is reproduced at the splitter output (X5).

Mode	Sensor1	Sensor2	Function	Achievable Safety Level
0	SIN+, SIN-, COS+,COS-	SIN+, SIN-, COS+,COS-	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe

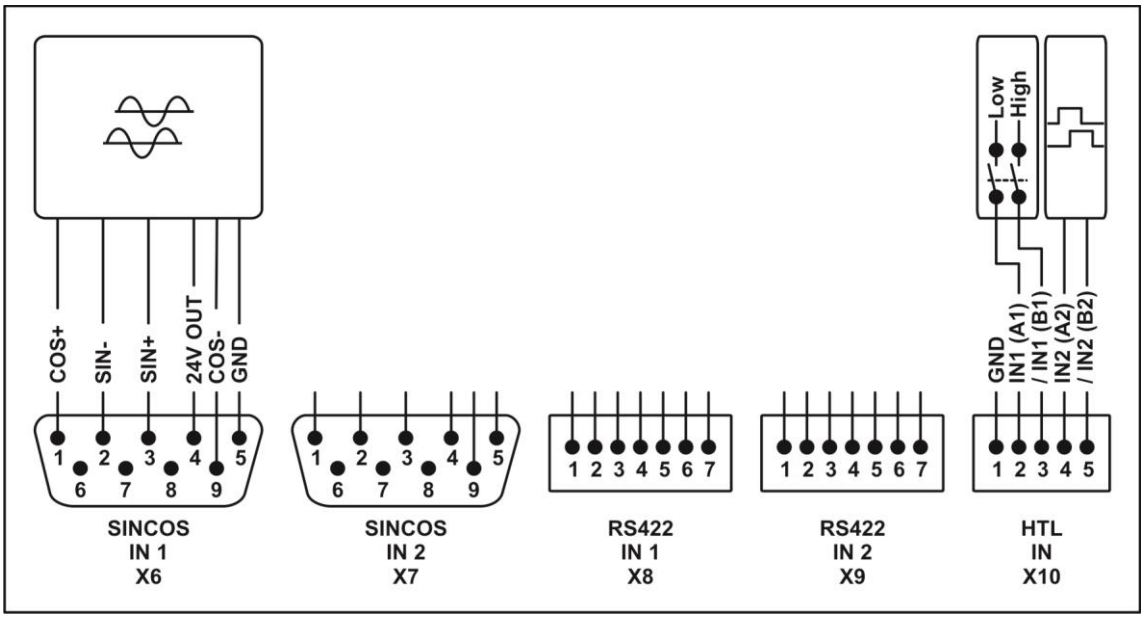
6.4. Operational Mode = 1

Mode	Sensor1	Sensor2	
1	SinCos encoder (SIN+, SIN-, COS+ and COS-)	Incremental encoder HTL (A and B)	

This mode allows evaluating a dual channel system, equipped with two different encoder types. Therefore a combination of a SinCos encoder and an incremental dual channel HTL encoder is used. The SinCos encoder must be performed in accordance to chapter 0 and the incremental to chapter 5.5.

The following connections are processed in this mode:

Mode	Sensor1	Sensor2	Command IN1	Command IN2
1	SinCos 1 [X6]	HTL2-A/B [X10/4,5]	available	not available



- A DS230 unit with an integrated encoder splitter offers the possibility to reproduce the SinCos 1 input (terminal X6) to the splitter output X5.
- Input SinCos 2 (terminal X7) has no function.
- When connecting the HTL encoder to terminal X10 (pin 4, 5), the Command 2 input is no more available. In this case only the Command 1 input can be used.

Mode	Sensor1	Sensor2	Function	Achievable Safety Level
1	SIN+, SIN-, COS+,COS-	HTL A, B	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe

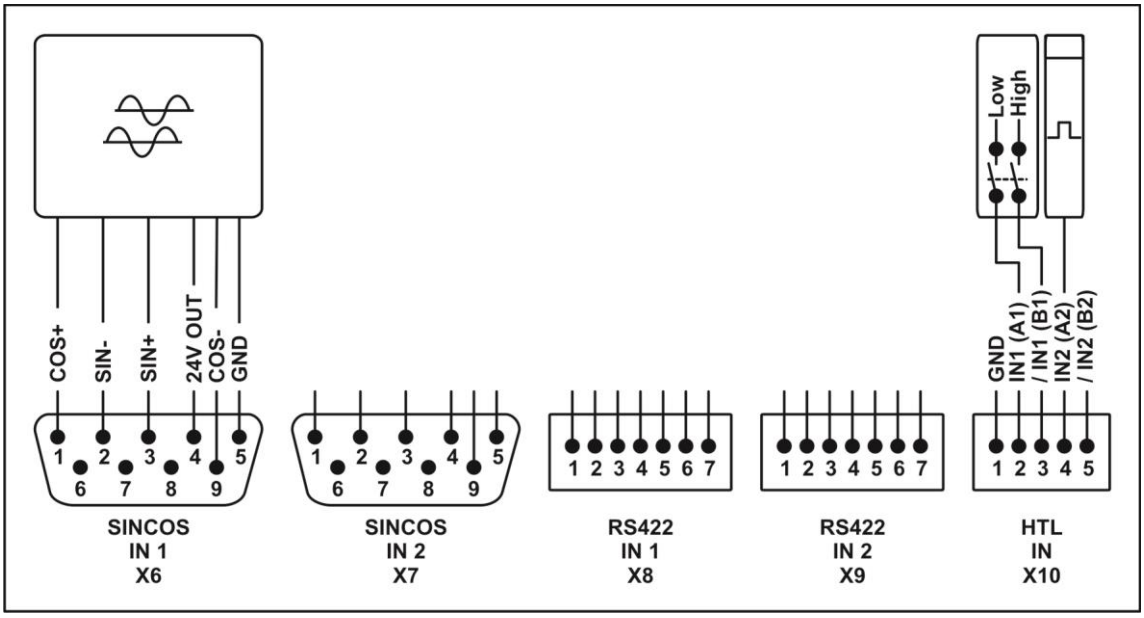
6.5. Operational Mode = 2

Mode	Sensor1	Sensor2
2	SinCos encoder (SIN+, SIN-, COS+ and COS-)	Incremental encoder HTL (A) or proximity switch

This mode allows evaluating a dual channel system, equipped with two different encoder types. Therefore a combination of a SinCos encoder and an incremental single channel HTL encoder is used. The SinCos encoder must be performed in accordance to chapter 0 and the incremental encoder to chapter 5.5.

The following connections are processed in this mode:

Mode	Sensor1	Sensor2	Command IN1	Command IN2
2	SinCos 1 [X6]	HTL2-A [X10/4]	available	not available



- For the SinCos encoder is only the input 1 at terminal X6 active. Input SinCos 2 (terminal X7) has no function.
- A DS230 unit with an integrated encoder splitter offers the possibility to reproduce the SinCos 1 input (terminal X6) to the splitter output X5.
- When connecting the HTL encoder to terminal X10 (pin 4), the Command 2 input is no more available. In this case only the Command 1 input can be used.

Mode	Sensor1	Sensor2	Function	Achievable Safety Level
2	SIN+, SIN-, COS+,COS-	HTL A or proximity switch	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe **** SIL3 / PLe ****

**** The safety level can only be achieved, if it is physically ensured, that there only can be a rotary or linear movement into one direction. This can be realized for example by using a self-locking gearbox.

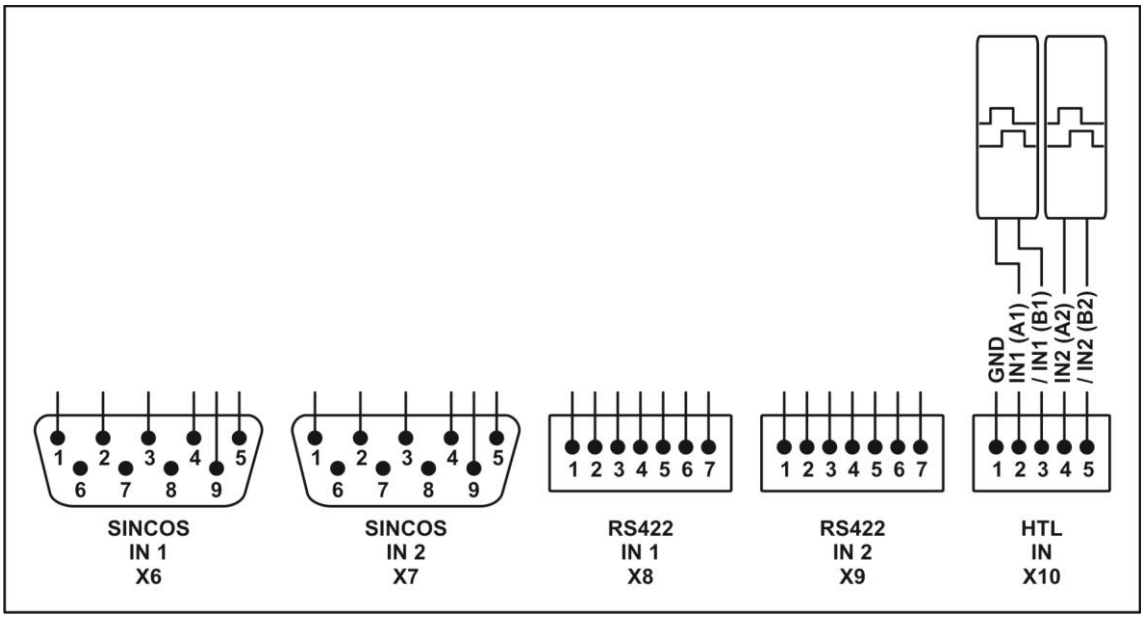
6.6. Operational Mode = 3

Mode	Sensor1	Sensor2
3	Incremental encoder HTL (A and B)	Incremental encoder HTL (A and B)

This mode allows evaluating a dual channel system, equipped with two incremental dual channel HTL encoders. The encoder must be performed in accordance to chapter 5.5.

The following connections are processed in this mode:

Mode	Sensor1	Sensor2	Command IN1	Command IN2
3	HTL1-A/B [X10/2,3]	HTL2-A/B [X10/4,5]	not available	not available



Please note, that no more command inputs are available, when connecting both encoders to terminal X10 (pin 2, 3 and 4, 5)!

Mode	Sensor1	Sensor2	Function	Achievable Safety Level
3	HTL A,B	HTL A,B	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe

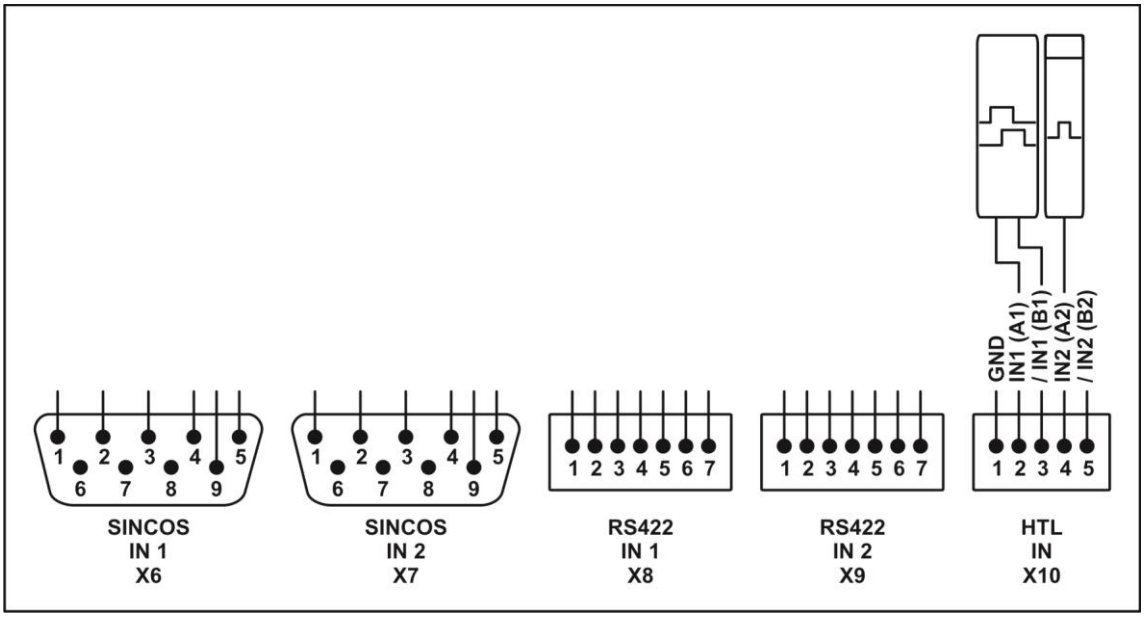
6.7. Operational Mode = 4

Mode	Sensor1	Sensor2	
4	Incremental encoder HTL (A and B)	Incremental encoder HTL (A) or proximity switch	

This mode allows evaluating a dual channel system, equipped with two different encoder types. Therefore a combination of an incremental dual channel as well as a single channel HTL encoder is used. The connections of both encoders must be performed in accordance to chapter 5.5.

The following connections are processed in this mode:

Mode	Sensor1	Sensor2	Command IN1	Command IN2
4	HTL1-A/B [X10/2,3]	HTL2-A [X10/4]	not available	not available



Please note, that no more command inputs are available, when connecting both encoders to terminal X10 (pin 2, 3 and 4)!

Mode	Sensor1	Sensor2	Function	Achievable Safety Level
4	HTL A,B	HTL A or proximity switch	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe **** SIL3 / PLe ****

**** The safety level can only be achieved, if it is physically ensured, that there only can be a rotary or linear movement into one direction. This can be realized for example by using a self-locking gearbox.

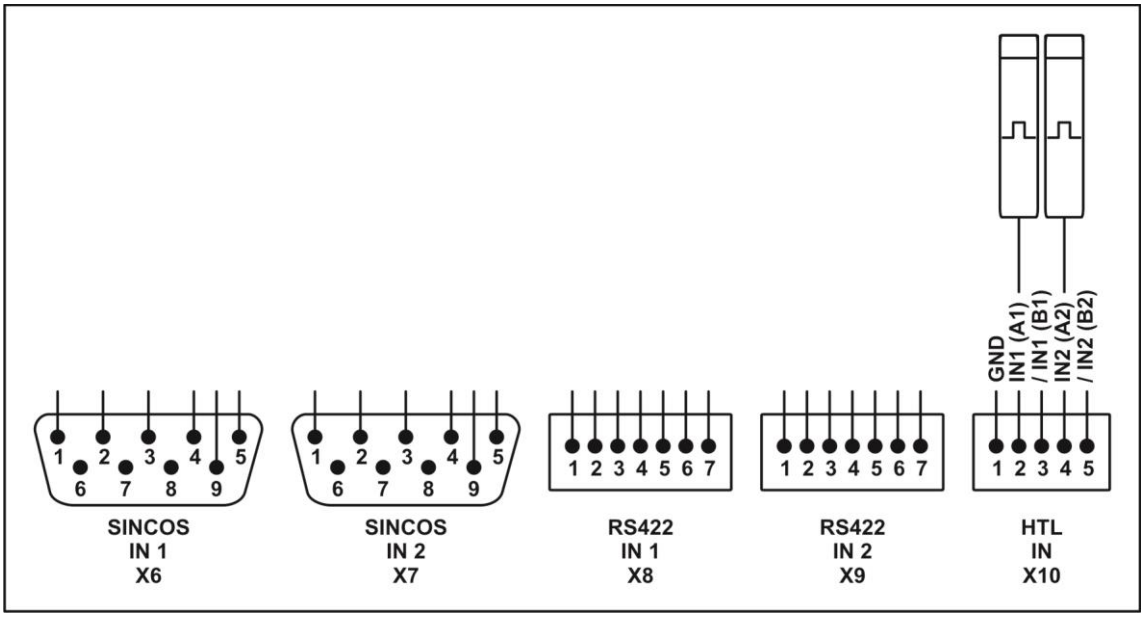
6.8. Operational Mode = 5

Mode	Sensor1	Sensor2	
5	Incremental encoder HTL (A) or proximity switch	Incremental encoder HTL (A) or proximity switch	

This mode allows evaluating a dual channel system, equipped with two identical encoder types. Therefore a combination of two incremental single channel HTL encoders is used. The connections of both encoders must be performed in accordance to chapter 5.5.

The following connections are processed in this mode:

Mode	Sensor1	Sensor2	Command IN1	Command IN2
5	HTL1-A [X10/2]	HTL2-A [X10/4]	not available	not available



Please note, that no more command inputs are available, when connecting both encoders to terminal X10 (pin 2 and 4)!

Mode	Sensor1	Sensor2	Function	Achievable Safety Level
5	HTL A or proximity switch	HTL A or proximity switch	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe **** SIL3 / PLe ****

**** The safety level can only be achieved, if it is physically ensured, that there only can be a rotary or linear movement into one direction. This can be realized for example by using a self-locking gearbox.

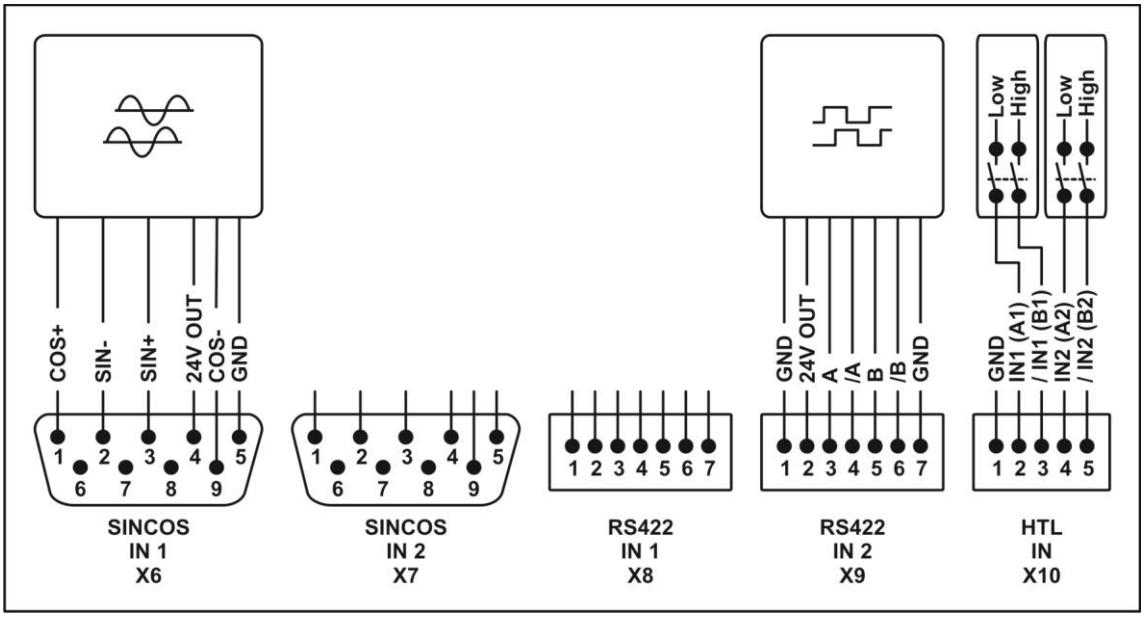
6.9. Operational Mode = 6

Mode	Sensor1	Sensor2	
6	SinCos encoder (SIN+, SIN-, COS+ and COS-)	Incremental encoder RS422 / TTL (A, /A, B and /B)	

This mode allows evaluating a dual channel system, equipped with two different encoder types. Therefore a combination of a SinCos and a RS422/TTL encoder is used. The SinCos encoder must be performed in accordance to chapter 0 and the RS422/TTL encoder to chapter 5.4.

The following connections are processed in this mode:

Mode	Sensor1	Sensor2	Command IN1	Command IN2
6	SinCos 1 [X6]	RS 422-2 [X9]	available	available



- For the SinCos encoder is only the input 1 at terminal X6 active. Input SinCos 2 (terminal X7) has no function.
- A DS230 unit with an integrated encoder splitter offers the possibility to reproduce the SinCos 1 input (terminal X6) to the splitter output X5.
- Further the incremental encoder at terminal X9 can be reproduced to the splitter output X4 with a DS230 unit.

Mode	Sensor1	Sensor2	Function	Achievable Safety Level
6	SIN+, SIN-, COS+,COS-	RS422 / TTL A, /A, B /B	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe

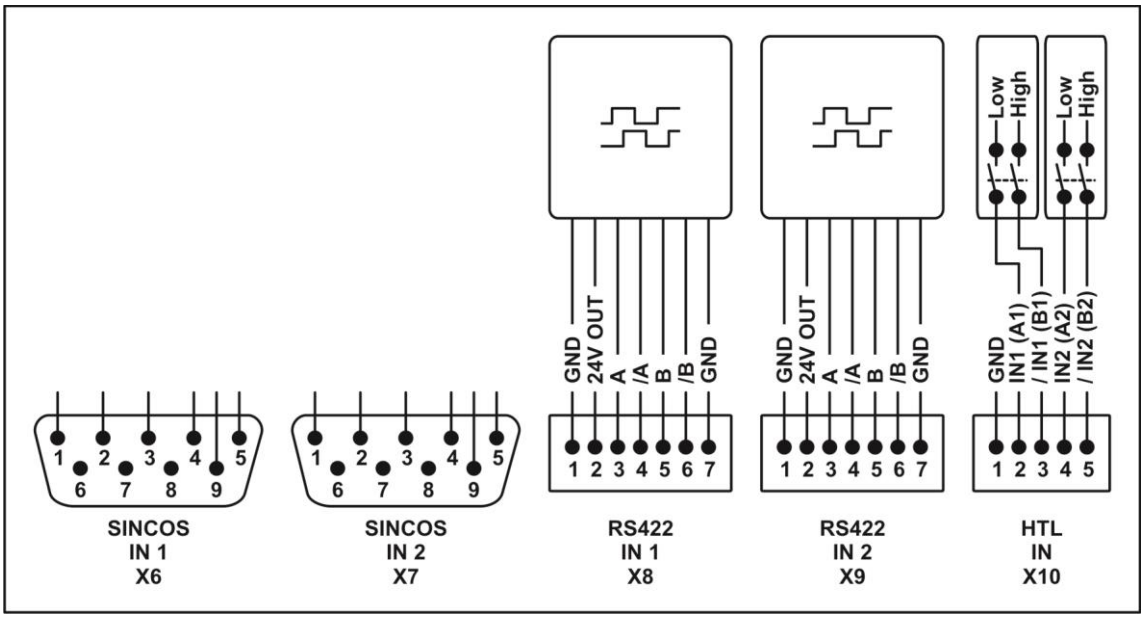
6.10. Operational Mode = 7

y	Sensor1	Sensor2	
7	Incremental encoder RS422 / TTL (A, /A, B and /B)	Incremental encoder RS422 / TTL (A, /A, B and /B)	

This mode allows evaluating a dual channel system, equipped with two identical RS422/TTL incremental encoders. The encoder must be performed in accordance to chapter 5.4.

The following connections are processed in this mode:

y	Sensor1	Sensor2	Command IN1	Command IN2
7	RS 422-1 [X8]	RS 422-2 [X9]	available	available



A DS230 unit with an integrated encoder splitter offers the possibility to reproduce either incremental input 1 (terminal X8) or incremental input 2 (terminal X9) to the splitter output X4.

Mode	Sensor1	Sensor2	Function	Achievable Safety Level
7	RS422 / TTL A, /A, B /B	RS422 / TTL A, /A, B /B	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe

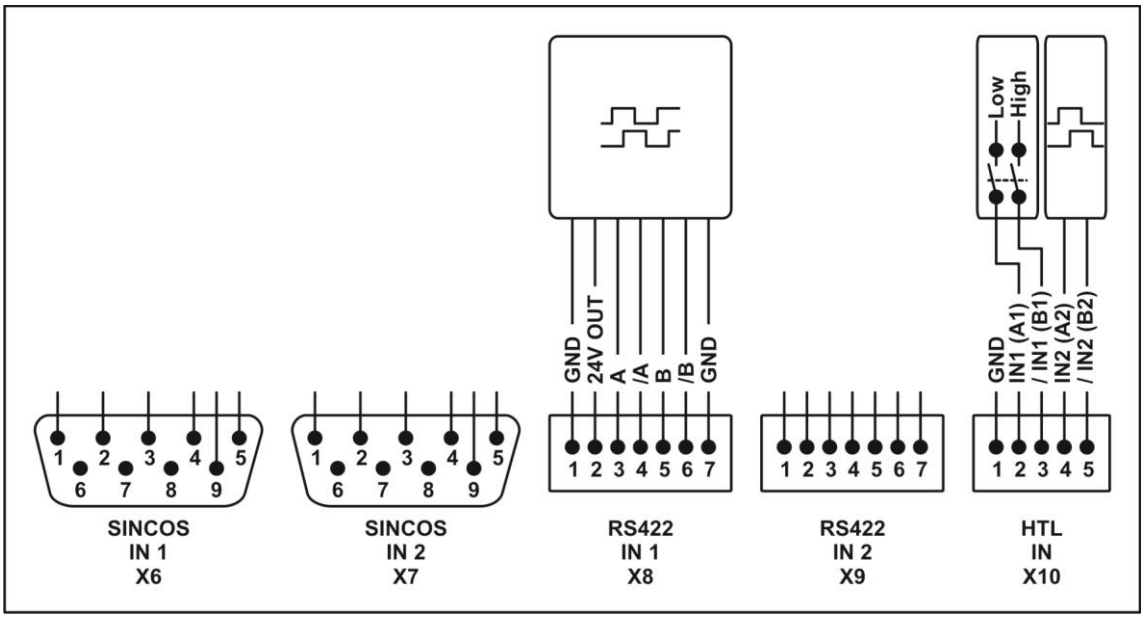
6.11. Operational Mode = 8

Mode	Sensor1	Sensor2
8	Incremental encoder RS422 / TTL (A, /A, B and /B)	Incremental encoder HTL (A and B)

This mode is used to evaluate a dual channel system, equipped by two different incremental encoder resp. sensor types. Therefore an incremental RS422/TTL and a dual channel HTL encoder are used. The RS422/TTL encoder must be performed in accordance to chapter 5.4 and the HTL encoder to chapter 5.5.

The following connections are processed in this mode:

Mode	Sensor1	Sensor2	Command IN1	Command IN2
8	RS 422-1 [X8]	HTL2-A/B [X10/4,5]	available	not available



- A DS230 unit with an integrated encoder splitter offers the possibility to reproduce the incremental input 1 at terminal X8 to the splitter output X4.
- When connecting the HTL encoder to terminal X10 (pin 4, 5), the Command 2 input is no more available. In this case only the Command 1 input can be used.

Mode	Sensor1	Sensor2	Function	Achievable Safety Level
8	RS422 / TTL A, /A, B /B	HTL A,B	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe

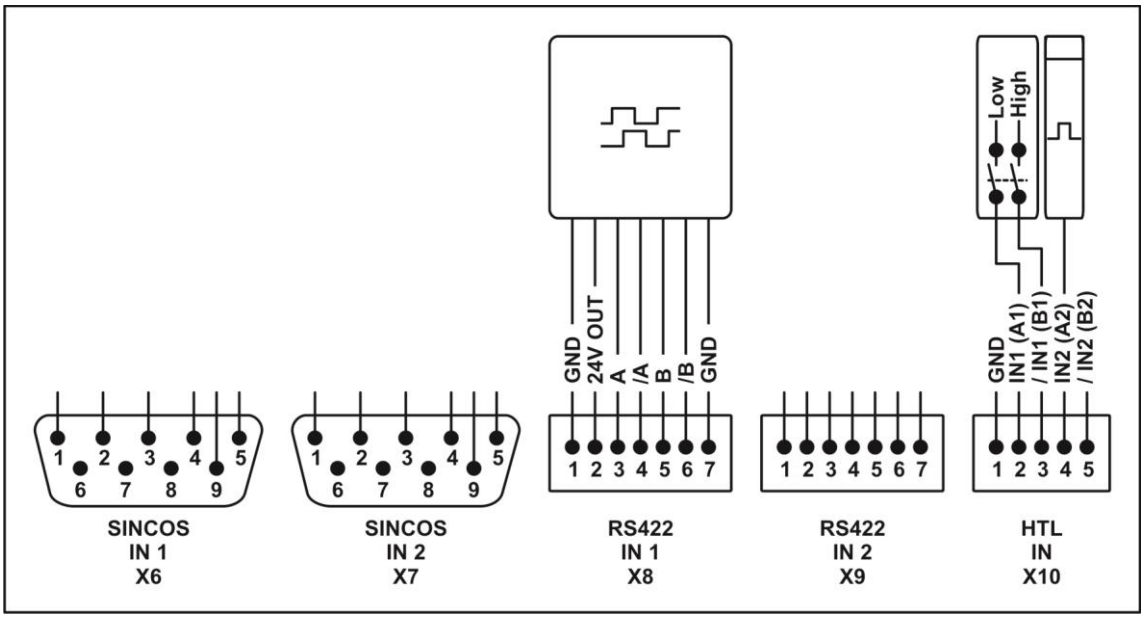
6.12. Operational Mode = 9

Mode	Sensor1	Sensor2	
9	Incremental encoder RS422 / TTL (A, /A, B and /B)	Incremental encoder HTL (A) or proximity switch	

This mode is used to evaluate a dual channel system, equipped by two different incremental encoder resp. sensor types. Therefore an incremental RS422/TTL encoder and a single-channel HTL encoder are used. The RS422/TTL encoder must be performed in accordance to chapter 5.4 and the HTL encoder to chapter 5.5.

The following connections are processed in this mode:

Mode	Sensor1	Sensor2	Command IN1	Command IN2
9	RS 422-1 [X8]	HTL2-A [X10/4]	available	not available



- A DS230 unit with an integrated encoder splitter offers the possibility to reproduce the incremental input 1 at terminal X8 to the splitter output X4.
- When connecting the HTL encoder to terminal X10 (pin 4), the Command 2 input is no more available. In this case only the Command 1 input can be used.

Mode	Sensor1	Sensor2	Function	Achievable Safety Level
9	RS422 / TTL A, /A, B /B	HTL A or proximity switch	Speed Direction Standstill	SIL3 / PLe SIL3 / PLe **** SIL3 / PLe ****

**** The safety level can only be achieved, if it is physically ensured, that there only can be a rotary or linear movement into one direction. This can be realized for example by using a self-locking gearbox.

7. Operational Mode of DS240 - DS246

7.1. Achievable Safety Level

Mode	Sensor1	Sensor2	Function	Achievable Safety Level
0	certificated SinCos encoder (SIN+, SIN-, COS+ und COS-)		Speed Direction Standstill	SIL3 / PLe SIL3 / PLe SIL3 / PLe

To achieve a maximum of SIL3/PLe on system-level, no certificated sensors are required for the fulfilment of the integration of the device. When using standard sensors, only the required safety level (by complying the safety-related characteristics SFF, HFT, Type A/B, PFH, PFD resp. category, DCavg and MTTFd) and systematic safety integrity must be ensured for overall protection circuit. Software programs (like SISTEMA) are very helpful for creating such evaluations of safety-related machine control systems according to the EN ISO 13849 norm.

7.2. „Operational Mode“ = 0

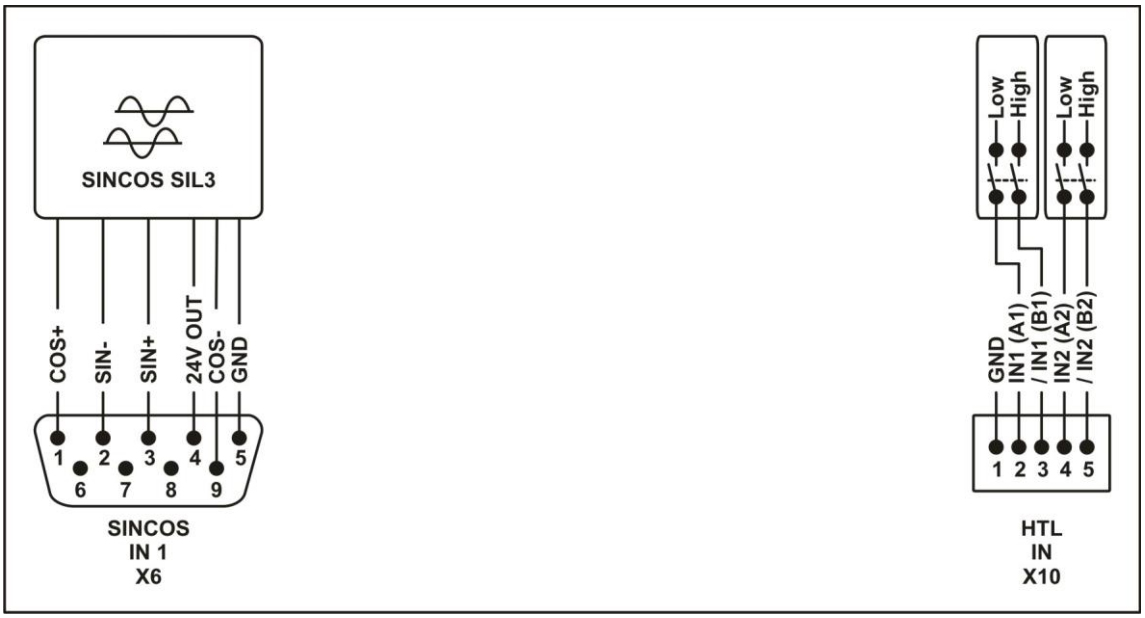
Mode	Sensor1	Sensor2	
0	Certificated SinCos encoder (SIN+, SIN-, COS+ und COS-)	N/A	

This operational mode serves only for a connection of a SIL3 resp. PLe certificated sensor or rotary encoder. The encoder type must be performed in accordance to chapter 0.

Please note: The HTL inputs of the versions DS240 to DS246 are only performed as pure command inputs, but not as frequency inputs.

The following connections are processed in this mode:

Mode	Sensor1	Sensor2	Command IN1	Command IN2
0	SinCos 1 [X6]		available	available



- A DS safety device with an integrated encoder splitter offers the possibility to reproduce the SinCos 1 input at terminal X6 to the splitter output X5..

8. Start-Up the Unit

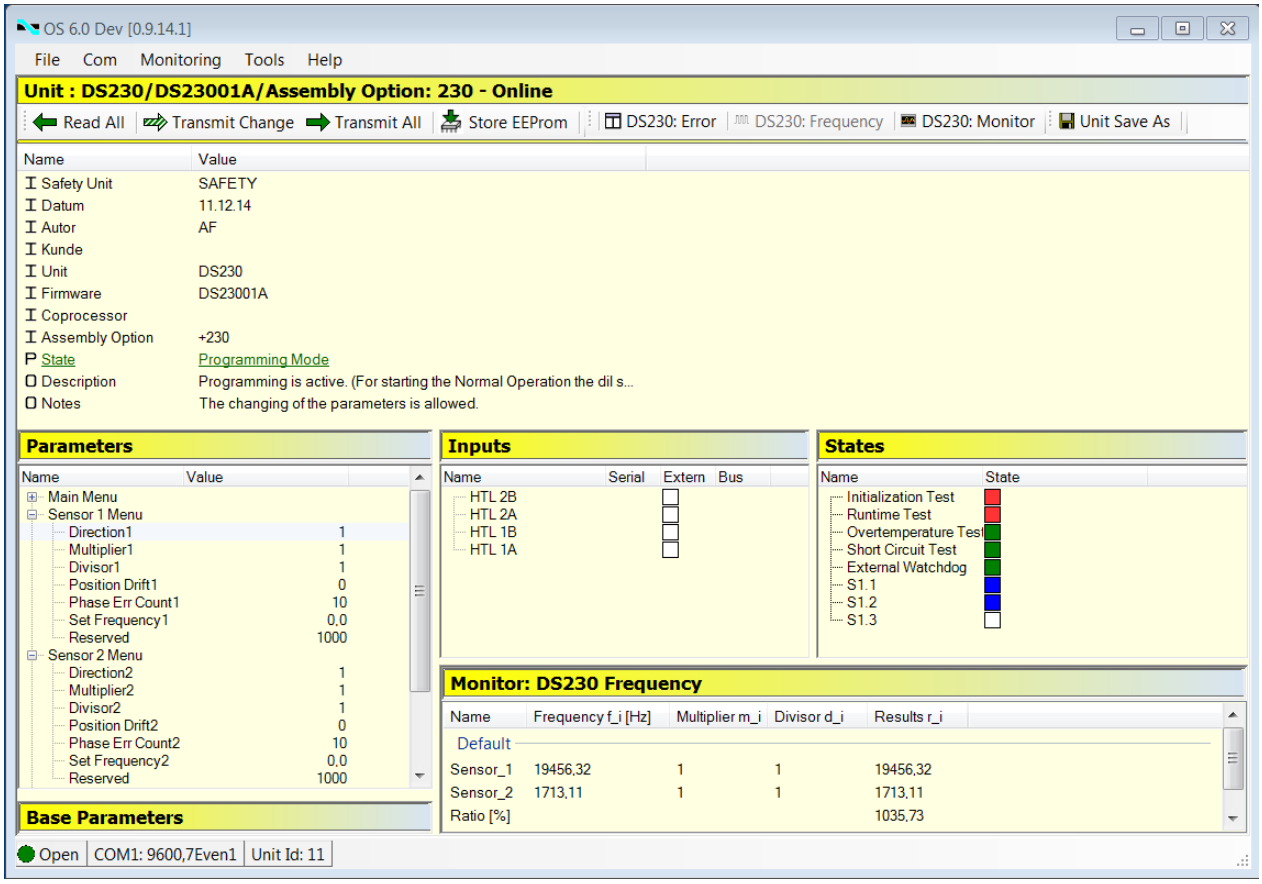
The following chapter describes the various options for setting and configuring the unit.
In order to put the unit into operation or to change settings and parameters, the following measures must be taken:

- Connect the unit to a 18 … 30 VDC power supply source
- Change the DIL-switch slider 3 to its OFF position (unit-state: „Programming Mode“)
- Connect the unit to the OS6.0 operator surface or alternatively to a BG230 programming- and display unit.

- „Programming Mode“ only for start-up
- Set all DIL-switch sliders to „ON“ after start-up
- Protect the DIL-switch sliders after start-up
  (e. g. by covering with an adhesive tape)
- Normal operation is only permitted when the yellow LED is permanently off

8.1. Setup by PC

The parameterization is performed by the USB port, which connects the unit to a PC with installed OS6.0 operator software. The software CD is included in the delivery and also available for download on www.motrona.com. Please connect the PC to the USB port.
When starting the software, the following screen appears:



The functions of the OS6.0 operator surface are described in the separate OS6.0 manual.

8.2. Setup by the Programming Module BG230

The optional display- and programming module BG230 is used for parameter settings and diagnosis without a PC. It is easily connectable by plugging onto the front of the safety unit.

The functions of the BG230 programming- and display unit are described in the BG230 manual.

8.3. Parameter / Menu Overview

This section provides an overview of the menus and their assignments to the different unit functions. The menu names are printed bold and associated parameters are arrayed directly under the menu names.

No.	Menu / Parameter
	Main Menu
000	Operational Mode
001	Sampling Time
002	Wait Time
003	F1-F2 Selection
004	Div. Switch %-f
005	Div. %-Value
006	Div. f-Value
007	Div. Calculation
008	Div. Filter
009	Error Simulation
010	Power-up Delay
011	Reserved
012	Reserved
	Sensor1 Menu
013	Direction 1
014	Multiplier 1
015	Divisor 1
016	Position Drift 1
017	Phase Err Count 1
018	Set Frequency 1
019	Reserved
	Sensor2 Menu
020	Direction 2
021	Multiplier 2
022	Divisor 2
023	Position Drift 2
024	Phase Err Count 2
025	Set Frequency 2
026	Reserved

No.	Menu / Parameter
	Preselect Menu
027	Preselect OUT1.H
028	Preselect OUT1.L
029	Preselect OUT2.H
030	Preselect OUT2.L
031	Preselect OUT3.H
032	Preselect OUT3.L
033	Preselect OUT4.H
033	Preselect OUT4.H
034	Preselect OUT4.L
035	Preselect REL1.H
036	Preselect REL1.L
037	Reserved
038	Reserved

Continuation “Parameter / Menu Overview”:

No.	Menu / Function
	Switching Menu
039	Switch Mode OUT 1
040	Switch Mode OUT 2
041	Switch Mode OUT 3
042	Switch Mode OUT 4
043	Switch Mode REL
044	Pulse Time OUT 1
045	Pulse Time OUT 2
046	Pulse Time OUT 3
047	Pulse Time OUT 4
048	Pulse Time REL
049	Hysteresis OUT 1
050	Hysteresis OUT 2
051	Hysteresis OUT 3
052	Hysteresis OUT 4
053	Hysteresis REL
054	Startup Mode
055	Startup Output
056	Standstill Time
057	Lock Output
058	Action Output
059	Action Polarity
060	Reserved
061	Reserved

No.	Menu / Function
	Command Menu
062	Input 1 Function
063	Input 1 Configuration
064	Input 2 Function
065	Input 2 Configuration
066	Reserved
067	Reserved
	Serial Menu
068	Serial Unit Nr.
069	Serial Baud Rate
070	Serial Format
071	Serial Page
072	Serial Init
073	Reserved
	Splitter Menu
074	RS Selector
075	Reserved
076	Reserved
077	Reserved
	Analog Menu
078	Analog Start
079	Analog End
080	Analog Gain
081	Analog Offset
082	Reserved
083	Reserved
084	Reserved

8.4. Parameter Description

8.4.1. Main Menu

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>000</td><td><u>Operational Mode (DS230, DS236)</u>:

Defines type and source of the input signals to be monitored. In order to ensure the safety function, two independent sensors are required.

The following signal inputs are available:
SinCos-1, SinCos-2, RS422-1, RS422-2, HTL-1, HTL-2

<table>
<tr><th>Mode</th><th colspan="2">Sensor1</th><th colspan="2">Sensor2</th></tr>
<tr><td>0</td><td>SinCos-1</td><td>[X6]</td><td>SinCos 2</td><td>[X7]</td></tr>
<tr><td>1</td><td>SinCos-1</td><td>[X6]</td><td>HTL2-A/B</td><td>[X10/4,5]</td></tr>
<tr><td>2</td><td>SinCos-1</td><td>[X6]</td><td>HTL2-A</td><td>[X10/4]</td></tr>
<tr><td>3</td><td>HTL1-A/B</td><td>[X10/2,3]</td><td>HTL2-A/B</td><td>[X10/4,5]</td></tr>
<tr><td>4</td><td>HTL1-A/B</td><td>[X10/2,3]</td><td>HTL2-A</td><td>[X10/4]</td></tr>
<tr><td>5</td><td>HTL1-A</td><td>[X10/2]</td><td>HTL2-A</td><td>[X10/4]</td></tr>
<tr><td>6</td><td>SinCos-1</td><td>[X6]</td><td>RS422-2</td><td>[X9]</td></tr>
<tr><td>7</td><td>RS422-1</td><td>[X8]</td><td>RS422-2</td><td>[X9]</td></tr>
<tr><td>8</td><td>RS422-1</td><td>[X8]</td><td>HTL2-A/B</td><td>[X10/4,5]</td></tr>
<tr><td>9</td><td>RS422-1</td><td>[X8]</td><td>HTL2-A</td><td>[X10/4]</td></tr>
</table>
</td><td>0 - 9</td><td>0</td></tr>
<tr><td></td><td><u>Operational Mode (DS240, DS246)</u>:

Defines type and source of the input signals to be monitored. In order to ensure the safety function, a SIL3/PLe certificated sensor is required.

<table>
<tr><th>Mode</th><th colspan="2">Sensor1</th></tr>
<tr><td>0</td><td>SinCos-1</td><td>[X6]</td></tr>
</table>
</td><td>0</td><td>0</td></tr>
<tr><td>001</td><td><u>Sampling Time</u>:

The time base parameter for the frequency estimation (sec.) is valid for both input channels together. The configured value corresponds to the <u>minimum</u> necessary measurement period, which has also a direct influence to the reaction time of the unit.</td><td>0,001 - 9,999 (sec.)</td><td>0,001</td></tr>
<tr><td>002</td><td><u>Wait Time</u>:

Defines the time (sec.) between 2 input pulses until „Frequency = 0“ is detected.
A pulse break of the adjusted duration resets the frequency to zero. All frequencies with a period longer than the wait time value will be interpreted and further processed as frequency = 0.</td><td>0,010 - 9,999 (sec.)</td><td>1,000</td></tr>
</table>

Continuation "Main Menu":

No.	Parameter	Range	Default
003	**F1-F2 Selection** (Basic Frequency Selection): This parameter determines which of both input frequencies (see Parameter 000) is monitored and processed as basic frequency. This mainly covers the preselected thresholds (see chapter 8.4.4) and the analog output (see chapter 8.4.9). 0: Frequency of sensor1 serves as basic frequency 1: Frequency of sensor2 serves as basic frequency	0 - 1	0
004	**Div. Switch %-f** (Divergence switching point %-Hz): The unit constantly compares the frequencies of sensor1 and Sensor2 to the adjusted, maximum allowed divergence. Usually the comparison works percentages. Application-specific with lower frequencies a percentages comparison can be problematic, so that a direct monitoring of the difference frequency in Hz can deliver better results. This parameter allows to define a limit. When undershooting the adjusted value the comparison will proceed no more percentages, but absolute in Hz (see parameter 006 and 006).	0 - 999.99 (Hz)	100.00
005	**Div. %-Value** (maximum Divergence %): Defines the maximum allowed percentage divergence between the frequencies of sensor1 and sensor2.* If this value is exceeded, the unit switches to an error status (see parameter 004).	0 - 100 (%)	10
006	**Div. f-Value** (maximum Divergence Hz): Defines the maximum allowed absolute divergence in Hz between the frequencies of sensor1 and sensor2.* If the adjusted value is exceeded, the unit switches to an error status (see parameter 004).	0 - 99,99 (Hz)	30,00
007	**Div. Calculation** (Divergence Calculation Mode): Defines a reference value in order to determine the percentage divergence.* 0: reference value is the frequency of sensor1: △(%) = (sensor1 - sensor2) : sensor1 x 100% 1: reference value is the frequency of sensor2: △(%) = (sensor2 - sensor1) : sensor1 x 100%	0 - 1	0

)* The evaluation is performed after adjusting the frequencies of sensor1 and sensor2 (see chapter 8.4.2 resp. 8.4.3)

Continuation "Main Menu":

No.	Parameter	Range	Default
008	**Div. Filter:** This digital filter parameter evaluates the divergence between sensor1 and sensor2. **0:** The filter is not active: The unit reacts immediately and spontaneously to each frequency deviation. **10:** Medium filter: The unit tolerates temporary deviations and fluctuations, e. g. caused from torsion or mechanical vibrations and reacts delayed to deviations between both input frequencies. **20:** Strongest filter: The unit tolerates temporary deviations and fluctuations, e. g. caused from torsion or mechanical vibrations and reacts with a very long delay to prolonged deviations between both input frequencies.	0 - 20	1
009	**Error Simulation:** This parameter takes effect **only in the "Programming Mode"** and serves only for test purposes during the commissioning procedure. It allows to simulate and prevent the following error messages: **0:** Sets the unit into alarm status. By using this parameter it is possible to check, if the entire follow-up system reacts correctly when alarm status. **1:** Normal setting without alarm release. Before exiting the "Programming Mode", the parameter always must be set to 1. **2:** Error suppression: All errors reported by the unit will be reset to zero. No alarm-message appears.	0 - 2	1
010	**Power-up Delay:** The adjusted delay time is used to start and stabilize the connected encoders safely after power-up the 24 V encoder supply (before the unit begins to evaluate signals).	1 - 1,000 (sec.)	0,100
011-012	**Reserved:**		

8.4.2. Sensor1 Menu

No.	Parameter	Range	Default
011	**Direction1** (Sensor1): Assigns a direction to sensor1 **0:** up **1**: down This allows reversing the direction of rotation of sensor1 in order to adjust them to the direction of rotation of sensor2. With SIN/COS or A/B input signals the basic direction is defined by the phase shift between both signals. With single-channel HTL signals (only channel A) the relevant channel B can be used for a static preset of the rotating direction.	0 - 1	0
012	**Multiplier1** (proportional pulse scaling factor): To adjust the frequencies of sensor1 and sensor2.	1 - 10 000	1
013	**Divisor1** (reciprocal pulse scaling factor): To adjust the frequencies of sensor1 and sensor2.	1 - 10 000	1
014	**Position Drift1** (drift monitoring at standstill): This parameter handles drift movements at standstill. If the period exceeds the adjusted „Wait-Time“ (see parameter 002), the sensor is assigned to frequency = 0, even if a slow drift movement is present. In case of an illegal drift, this parameter allows to preset an alarm threshold (symmetrical position window +/- xxx pulses). The monitoring is only performed at standstill and begins at position 0, immediately when frequency = 0 is detected. **0:** Drift monitoring not active **xxx:** An alarm message appears, when the position is drifting out of the adjusted window of +/- xxx pulses.	0 - 100 000	0

When using two encoders with differing pulse rates or in case of a mechanical reduction between both encoders, the higher frequency must be converted to the lower frequency by using the scaling factors (see chapter Fehler! Verweisquelle konnte nicht gefunden werden..).

Continuation "Sensor1 Menu":

No.	Parameter	Range	Default
015	Phase Err Count1 (faulty pulse counting limit): Incorrect pulses can result from faulty wirings, EMC-problems, wrong operation mode settings, but also directly when switching on the encoder-supply or changing the direction parameter. The alarm status is released when exceeding the number of faulty pulses adjusted here.	1- 1 000	10
016	Set Frequency1 (simulation of a fixed encoder frequency): This parameter takes effect **only in the "Programming Mode".** It is used for test purposes and allows to substitute the real encoder frequency by a fixed frequency (see also chapter 8.4.6).	-500 000.0 - 500 000.0 (Hz)	0
017-018	Reserved:		

8.4.3. Sensor2 Menu

No.	Parameter		Range	Default
019	Direction2:	The description of the sensor2 parameters is identically with the sensor1 menu, but all settings are related to sensor2 which is specified by the „Operation Mode".	0 - 1	0
020	Multiplier2:		1- 10 000	1
021	Divisor2:		1 - 10 000	1
022	Position Drift2:		0 - 100 000	0
023	Phase Err Count2:		1 - 1 000	10
024	Set Frequency2:		-500 000.0 - 500 000.0 (Hz)	0
025-026	Reserved:			

When using 2 encoders with differing pulse rates or in case of a mechanical reduction between both encoders, the higher frequency must be converted to the lower frequency by using the scaling factors *(see chapter Fehler! Verweisquelle konnte nicht gefunden werden..).*

8.4.4. Preselect Menu

This menu serves for setting the switching points of the relay-output [X1] and the four control outputs [X2]. All settings are related to the selected basic frequency (see parameter 003) considering to the adjusted scaling factor of the basic sensor (see chapter 8.4.2).

There are two separate limit values for each output, which can be changed by an external signal, e. g. changeover between "set-up mode" and "production mode".

The changeover between limit values „High" and „Low" can be released by using one of the four control inputs at terminal [X10], unless these are not defined as sensor-input by the „Operational Mode" (parameter 000). Therefore the function „Preselection Change" must be assigned to an unused input (see chapter 8.4.6 / parameter 062 = 13).

Index „H" stands for „High" and requires a higher limit value.
Index „L" stands for „Low" and requires a lower limit value.

- **The upper switching point (index .H) is only active, if no error can be detected and if an external signal is triggered to the control input according to chapter 8.4.6.**
- **The operator has to assign the values to the switch-points correctly. The "High" value must be higher than the "Low" value.**

No.	Parameter	Range	Default
027	Preselect OUT1.H: Upper switching point of output OUT1 [Terminal X2/1, 2]	-500 000.0 - 500 000.0 Operation units in accordance to the scaling (see chapter 8.4.2)	10 000
028	Preselect OUT1.L: Lower switching point of output OUT1 [Terminal X2/1, 2]		20 000
029	Preselect OUT2.H: Upper switching point of output OUT2 [Terminal X2/3, 4]		30 000
030	Preselect OUT2.L: Lower switching point of output OUT2 [v X2/3, 4]		40 000
031	Preselect OUT3.H: Upper switching point of output OUT3 [Terminal X2/5, 6]		50 000
032	Preselect OUT3.L: Lower switching point of output OUT3 [Terminal X2/5, 6]		60 000
033	Preselect OUT4.H: Upper switching point of output OUT4 [Terminal X2/7, 8]		70 000
034	Preselect OUT4.L: Lower switching point of output OUT4 [Terminal X2/7, 8]		80 000
035	Preselect RELAY.H: Upper switch-point of the relay output [Terminal X1/1, 2]		1 000
036	Preselect RELAY.L: Lower switching point of the relay output [Terminal X1/1, 2]		2 000
037-038	Reserved:		

8.4.5. Switching Menu

The following form of writing **|f|** and **|Preselection|** is used for the absolute amount of frequency resp. preset value, whilst **f** and **Preselection** displays the direction-dependent and categorically signed variant.

{S} = Lock, **{H}** = Switching Hysteresis, **{A}** = Start-Up Suppression
Additional features which can be assigned to the output and its respective switching condition.

No.	Parameter	Range	Default
039	**Switch Mode OUT1** (switching condition for OUT1)**:** **0:** |f| >= |Preselection| * {S, H} **1:** |f| <= |Preselection| * {S, H, A} **2:** |f| == |Preselection| * {S, H, A} **3:** Standstill (both frequencies are 0 and standstill time has elapsed) **4:** f >= Preselection * {S, H} May only be used with positive preselection values! (also suitable for signalling clockwise direction) **5:** f <= Preselection * {S, H, A} May only be used with positive preselection values! (also suitable for signalling counter clockwise direction) **6:** f == Preselection * {S, H, A} May only be used with positive preselection values! **7:** f > 0 The output indicates a clockwise direction, when a positive frequency is detected. The directional information will be deleted immediately when „standstill". **8:** f < 0 The output indicates a counter clockwise direction if a negative frequency is detected. The directional information will be deleted immediately when „standstill". *) see chapter 8.4.4 for more information about the „Preselection"	0 - 8	0

- A hysteresis is particularly important when 2 and 6 is adjusted. The hysteresis will then avoid a flashing of the outputs around the switching points.
- With negative measuring values and presets a higher numerical value is smaller than a lower numerical value, thus e. g. -1000 < -500
- When using Switch Mode 7 or 8 the specified standstill-time must be higher than the adjusted wipe period, in order to prevent a breakdown of the wipe signal before the wipe period has been elapsed.

Continuation "Switching Menu":

No.	Parameter	Range	Default
040	Switch Mode OUT2 (switching condition for OUT2): Settings are analogous to „Switch Mode OUT1"	0 - 8	0
041	Switch Mode OUT3 (switching condition for OUT3): Settings are analogous to „Switch Mode OUT1"	0 - 8	0
042	Switch Mode OUT4 (switching condition for OUT4): Settings are analogous to „Switch Mode OUT1"	0 - 8	0
043	Switch Mode RELAY (switching condition for relay output): Settings are analogous to „Switch Mode OUT1"	0 - 8	0
044	Pulse Time OUT1 (Wipe Signal Period of OUT1): 0: static wipe signal ≠0: wipe signal period in seconds	0 - 9.999 (sec.)	0
045	Pulse Time OUT2 (Wipe Signal Period of OUT2): Settings are analogous to „Pulse Time OUT1"		
046	Pulse Time OUT3 (Wipe Signal Period of OUT3): Settings are analogous to „Pulse Time OUT1"		
047	Pulse Time OUT4 (Wipe Signal Period of OUT4): Settings are analogous to „Pulse Time OUT1"		
048	Pulse Time RELAY (Wipe Signal Period of the relay): Settings are analogous to „Pulse Time OUT1", but min. 0.025 sec.		
049	Hysteresis* OUT1:	0- 100.0 (%)	0
050	Hysteresis* OUT2:		
051	Hysteresis* OUT3:		
052	Hysteresis* OUT4:		
053	Hysteresis* RELAY:		

- The minimum wipe period of the control outputs is 1 msec.
  The minimum wipe period of the relay is 25 msec.
- An output cannot be assigned to a wipe period and a lock at the same time.
- When using Switch Mode 7 or 8 the specified standstill-time must be higher than the adjusted wipe period, in order to prevent a breakdown of the wipe signal before the wipe period has been elapsed.

*) percentage hysteresis of the adjusted switch point (see chapter 8.4.4.)

Continuation "Switching Menu":

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>054</td><td><u>Startup Mode</u> (start-up delay time):

Delay time until the monitoring function is activated. Only useful in combination with switching mode 1 and 5 (see chapter 8.4.5).

The start-up delay will be activated:
a) at power-up
b) always when after a detected standstill a frequency is detected again

0: no start-up delay
1: start-up delay = 1 second
2: start-up delay = 2 seconds
3: start-up delay = 4 seconds
4: start-up delay = 8 seconds
5: start-up delay = 16 seconds
6: start-up delay = 32 seconds
7: start-up delay = 64 seconds
8: start-up delay = 128 seconds
9: automatically, up to the first exceeding of the value</td><td>0 - 9</td><td>0</td></tr>
<tr><td>055</td><td><u>Startup Output</u> (assignment of a start-up delay to an output):

By using a 5 bit binary code the start-up delay function can be assigned to the outputs. Settings see below:
<table><tr><th>Output:</th><th>RELAY</th><th>OUT4</th><th>OUT3</th><th>OUT2</th><th>OUT1</th></tr><tr><td>Bit</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr><tr><td>Value:</td><td>16</td><td>8</td><td>4</td><td>2</td><td>1</td></tr><tr><td>Binary:</td><td>10000</td><td>01000</td><td>00100</td><td>00010</td><td>00001</td></tr></table>For example an adjustment of „17" (binary 10001) means that a start-up delay is assigned to OUT1 and also to the relay-output.</td><td>0 - 31

(Hex 0 - 1F)</td><td>0</td></tr>
<tr><td>056</td><td><u>Standstill Time</u> (delay time for definition of „standstill"):

Prior condition is that both input frequencies are detected as „Zero". From that point on, the standstill period runs off and indicates „Standstill" when elapsed.</td><td>0 - 9.999
(sec.)</td><td>0</td></tr>
</table>

<u>No</u> frequency monitoring resp. frequency comparison is processed during the start-up delay!

Continuation "Switching Menu":

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>057</td><td><u>Lock Output</u> <u>(assignment of a lock-function to an output)</u>:

The assignment of a lock-function to an output can be adjusted by using a 6 bit binary code as follows:

<table>
<tr><td>Output:</td><td>(*)</td><td>RELAY</td><td>OUT4</td><td>OUT3</td><td>OUT2</td><td>OUT1</td></tr>
<tr><td>Bit</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>Value:</td><td>32</td><td>16</td><td>8</td><td>4</td><td>2</td><td>1</td></tr>
<tr><td>Binary:</td><td>100000</td><td>010000</td><td>001000</td><td>000100</td><td>000010</td><td>000001</td></tr>
</table>
Bits 1 to 5 are used to assign the lock function to the respective outputs. The highest valued bit 6 (*) determines if a locked output can be released exclusively by an external input signal (bit 6 = 0) - see chapter 8.4.6 - or additionally by an automatic reset when "Standstill" is indicated (bit 6 = 1).

For example an adjustment of 17 (binary 10001) means that a lock is assigned to output Out1 and to the relay, which can be released exclusively by an external input signal (see chapter 8.4.6).

Further the adjustment 49 (binary 110001) means that the lock-functions of OUT1 and the relay are deleted additionally when „Standstill" is detected.</td><td>0 - 63

(Hex 0 - 3F)</td><td>0</td></tr>
<tr><td>058</td><td><u>Action Output</u> <u>(output selection for overwriting)</u>:

The function to set fixed output conditions by overwriting is only effective in the "Programming Mode". It is used for test purposes and allows to force each output to an arbitrary switching condition. The „Action Output" parameter (described here) selects the outputs to be tested. The next parameter „Action Polarity" is used to assign the desired switching conditions to the selected outputs.

The outputs are selectable by using a 5 bit binary code:

<table>
<tr><td>Output:</td><td>RELAY</td><td>OUT4</td><td>OUT3</td><td>OUT2</td><td>OUT1</td></tr>
<tr><td>Bit</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>Value:</td><td>16</td><td>8</td><td>4</td><td>2</td><td>1</td></tr>
<tr><td>Binary:</td><td>10000</td><td>01000</td><td>00100</td><td>00010</td><td>00001</td></tr>
</table>
For example the setting 14 (binary 01110) means that the outputs OUT2, OUT3 and OUT4 are selected for overwriting.</td><td>0 - 31

(Hex 0 - 1F)</td><td>0</td></tr>
</table>

Continuation "Switching Menu":

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>059</td><td><u>Action Polarity</u> (setting the output conditions):

This setting-function is only effective in the "Programming Mode" and requires a selection of the corresponding outputs (see parameter 058).

For security reasons the 4 digital outputs are complementary, which means that each output has one direct track and an inverse one (marked by a slash „/"). During normal operation both tracks generally must have opposite conditions, but in the test-mode arbitrary output-conditions can be simulated.

The output-conditions are assignable by a 9 bit binary code:

<table>
<tr><td>OUT:</td><td>REL</td><td>4</td><td>/4</td><td>3</td><td>/3</td><td>2</td><td>/2</td><td>1</td><td>/1</td></tr>
<tr><td>Bit</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>Value:</td><td>256</td><td>128</td><td>64</td><td>32</td><td>16</td><td>8</td><td>4</td><td>2</td><td>1</td></tr>
</table>

Thus a setting of 275 (binary 1 0001 0011) would result in the following output conditions (from left to right):

REL = 1
OUT4 = 0, /OUT4 = 0, OUT3 = 0, /OUT3 = 1
OUT2 = 0, /OUT2 = 0, OUT1 = 1, /OUT1 = 1</td><td>0 - 511

(Hex 0 - 1FF)</td><td>0</td></tr>
<tr><td>060</td><td>Reserved:</td><td></td><td></td></tr>
<tr><td>061</td><td>Reserved:</td><td></td><td></td></tr>
</table>

8.4.6. Command-Menu

This chapter describes the features and configuration options of the control inputs. Depending on the operating mode (see chapter 8.4.1), up to two control inputs are available.

This chapter contains information regarding functions and configurations the control input.

For security reasons both control inputs IN1 at [X10] 2, 3 and IN2 at [X10] 4, 5 are complementary.

To activate a signal the respective direct input must be HIGH and its appendant inverse input LOW. For example [IN1] = Hi and [/IN1] = Lo or respective [IN2] = Hi and [/IN2] = Lo.

For deactivation the respective direct input must be LOW and its appendant inverse input HIGH. For example [IN1] = Lo and [/IN1] = Hi or respective [IN2] = Lo and [/IN2] = Hi.

All other conditions are invalid and will not be accepted by the unit.

If the commands „Set Frequency" and „Freeze Frequency" are activated simultaneously by the external control inputs, the function „Set Frequency" has priority.

Command-Menu

No.	Parameter	Range	Default
062	**Input 1 Function** (assigns a control function to input „IN1“): The function will be active, if input IN1 is HIGH und /IN1is LOW! **0:** no function assigned **1:** release lock of output „OUT1“ [dyn] **2:** release lock of output „OUT2“ [dyn] **3:** release lock of output „OUT3“ [dyn] **4:** release lock of output „OUT4“ [dyn]] **5:** release lock of output „RELAY“ [dyn] **6:** release all output locks together [dyn] **7:** set frequency 1 (replace frequency by a fixed value) [stat] [PRG] **8:** set frequency 2 (replace frequency by a fixed value) [stat] [PRG] **9:** set frequency 12 (replace both frequencies together) [stat] [PRG] **10:** freeze frequency 1 [stat] [PRG] **11:** freeze frequency 2 [stat] [PRG] **12:** freeze frequency 12 (both frequencies together) [stat] [PRG] **13:** preselection change (switchover Preselect H) [stat] **14:** clear Drift 1 (clear counter for position drift 1) [dyn] **15:** clear Drift 2 (clear counter for position drift 2) [dyn] **16:** clear Drift 12 (clear both counters together) [dyn]	0 - 16	0
063	**Input 1 Config** (switching condition of input „IN1“): **0:** static function, active LOW: [IN1] = Lo, [/IN1] = Hi **1:** static function, active HIGH: [IN1] = Hi, [/IN1] = Lo **2:** dynamic function when moving from HIGH to LOW [IN1] and simultaneous move from LOW to HIGH [/IN1] **3:** dynamic function when moving from LOW to HIGH [IN1] and simultaneous move from HIGH to LOW [/IN1]	0 - 3	0
064	**Input 2 Function** (assigns a control function to input „IN2“): Identical functions to parameter 062, but for input “IN2”	0 - 16	0
065	**Input 2 Config** (switching condition of the input „IN2“): Identical functions to parameter 063, but for input “IN2”	0 - 3	0
066	**Reserved:**		
067	**Reserved:**		

[dyn] = dynamic function if a rising edge appears at the input
[stat] = static permanent function
[PRG] = function only in the “Programming Mode” active

8.4.7. Serial Menu

No.	Parameter	Range	Default
068	**Serial Unit Nr.** (assigns a serial unit number): The devices can be assigned by unit numbers between 11 and 99 (default setting = 11). Unit numbers which contain a "0" are forbidden because these are used for group- or bulk-addressing.	11 - 99	11
069	**Serial Baud Rate** (serial transmission speed): 0: 9 600 Baud 1: 4 800 Baud 2: 2 400 Baud 3: 1 200 Baud 4: 600 Baud 5: 19 200 Baud 6: 38 400 Baud 7: 56 000 Baud 8: 57 200 Baud 9: 76 800 Baud 10: 115 200 Baud	0 - 10	0
070	**Serial Format** (format of the serial data): 0: 7 data bits, parity even, 1 stop bit 1: 7 data bits, parity even, 2 stop bits 2: 7 data bits, parity odd, 1 stop bit 3: 7 data bits, parity odd, 2 stop bits 4: 7 data bits, no parity*, 1 stop bit 5: 7 data bits, no parity*, 2 stop bits 6: 8 data bits, parity even, 1 stop bit 7: 8 data bits, parity odd, 1 stop bit 8: 8 data bits, no parity*, 1 stop bit 9: 8 data bits, no parity*, 2 stop bits	0 - 9	0

*) „no parity": no secure data transmission guaranteed.
The parity bit must be set for a secure data transmission.

Continuation „Serial Menu“:

No.	Parameter	Range	Default
071	**Serial Page** (serial page number of a variable): The parameter serves only for diagnosis purposes by using the OS6.0 operator surface. For a clear presentation the variables are deposited in different pages (variable-groups). 0: General 1: ADC Field 1 2: ADC Field 2 3: ADC/DAC Field 3 4: GPI Field 5: Position 1 & 2 6: RTI, Watchdog, CAP 7: Error 8: Outputs 9: USB 10: Test 11: For a complete overview see chapter 12. The variables 0 … 9 are identically on all pages!	0 - 11	0
072	**Serial Init** This parameter determines the baud rate for the transmission of the initialization values to the operator surface OS6.0 respectively to the BG230 programming- and display unit. 0: The initialization values will be transmitted with 9600 baud. After initialization the unit works with the user settings again. 1: The initialization values will be transmitted with the user defined baud rate. After initialization the unit works with the user settings again. With settings higher than 9600 baud, the duration of the initialization procedure can be shortened.	0 - 1	0
073	**Reserved:**		

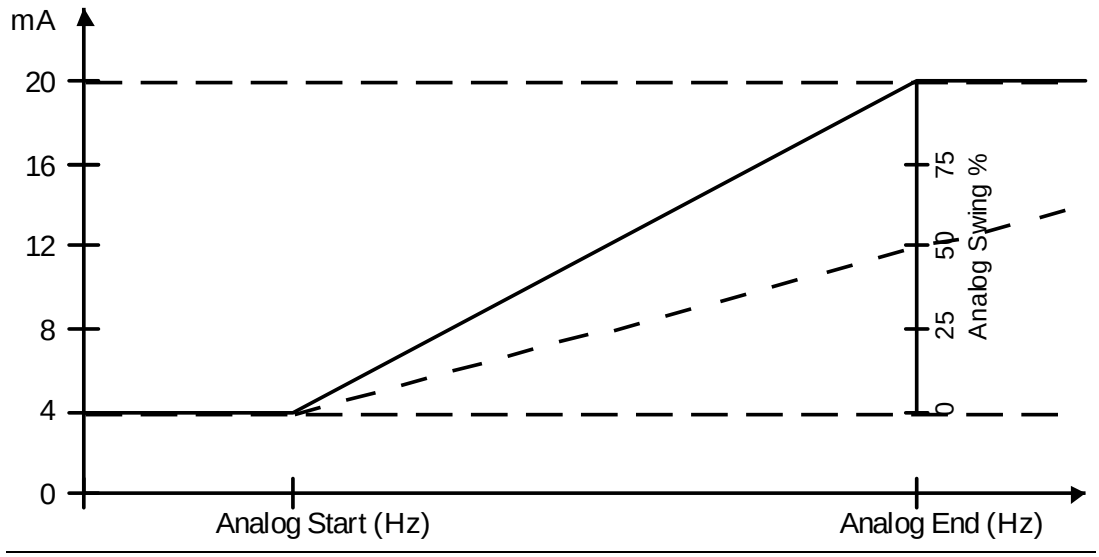
8.4.8. Splitter Menu
(Looping of Sensor Signals for further Target Units)

No.	Parameter	Range	Default
074	**RS Selector** (determination of the RS422 output source): Which input is assigned to which channel (Sensor1 or Sensor2) is set in the operating mode (see chapter 8.4.1 / Parameter 000). **0:** Source = Sensor1 A copy of the sensor1 input signal (as specified by parameter 000) appears at the RS422 output [X4]. If sensor1 is a SinCos encoder, the SinCos signal will be converted into a square wave signal. **1:** Source = Sensor2 A copy of the sensor2 input signal (as specified by parameter 000) appears at the RS422 output [X4]. If sensor2 is a SinCos encoder, the SinCos signal will be converted into a square wave signal.	0 - 1	0
075	**Reserved**		
076	**Reserved**		
077	**Reserved**		

8.4.9. Analog Menu
(Analog Output Configuration)

The setting of the F1-F2-Selection (parameter 003) determines, which frequency (sensor1 or sensor2) is used to generate the analog output signal.

No.	Parameter	Range	Default
078	**Analog Start** (initial value of the conversion range in Hz): Defines the initial frequency, at which the analog output should set its initial value of 4 mA.	-500 000.0 - 500 000.0 (Hz)	0
079	**Analog End** (final value of the conversion range in Hz): Defines the final frequency, at which the analog output should set its final value of 20 mA.		100 000
080	**Analog Gain** (gain of the D/A converter in %): With a setting of 100% the frequency curve between „Analog Start“ and „Analog End“ equates to the whole stroke from 4 mA to 20 mA (thus 16 mA). With a setting of e. g. 50 % the stroke would be only 8 mA and the analog output only a value of 4 + 8 = 12 mA when reaching „Analog End“.	1 - 1 000 (%)	100
081	**Analog Offset** (fine adjustment of the zero point in µA): Accurate adjustment of the analog offset within a fine range.	-25 - 25 (µA)	0
082 ff	**Reserved:**		



9. Start-Up the Plant

- „Programming Mode“ only for start-up
- Set all DIL-switch sliders to „ON“ after start-up
- Protect the DIL-switch sliders after start-up
  (e. g. by covering with an adhesive tape)
- Normal operation is only permitted when the yellow LED is permanently off

9.1. Cabinet installation

- The unit must be in a mechanically and technically perfect condition.
- The unit must be snapped onto a 35 mm DIN rail by using the clip at the rear.
- It must be ensured that the permissible environmental conditions of the specification are met accordingly.
- All wirings must be executed in accordance with the general provisions for wiring (see www.motrona.com).

9.2. Preparation before first start-up

Before first start-up

- ✓ the unit must be in a perfect technical condition, properly installed and wired
- ✓ the unit must be set to the unit-state “Programming Mode” by setting the DIL-switch slider 3 “OFF”
- ✓ the unit must be connected via the USB port to a PC / notebook or alternatively to an optional BG320 programming- and display unit
- ✓ the operator surface OS6.0 must be installed correctly and running on the PC
- ✓ all parameters must be set to correct values

- Commissioning may only be performed by qualified personnel.
- The machine / equipment must be protected from unauthorized persons, because undefined states of the machine / plant can occur during the first start up procedure.
- The machine must be securely mounted and ready to operate.
- The safety function of the unit cannot be guaranteed before the commissioning is completed.

9.3. Checklist for Parameter Settings

General settings:

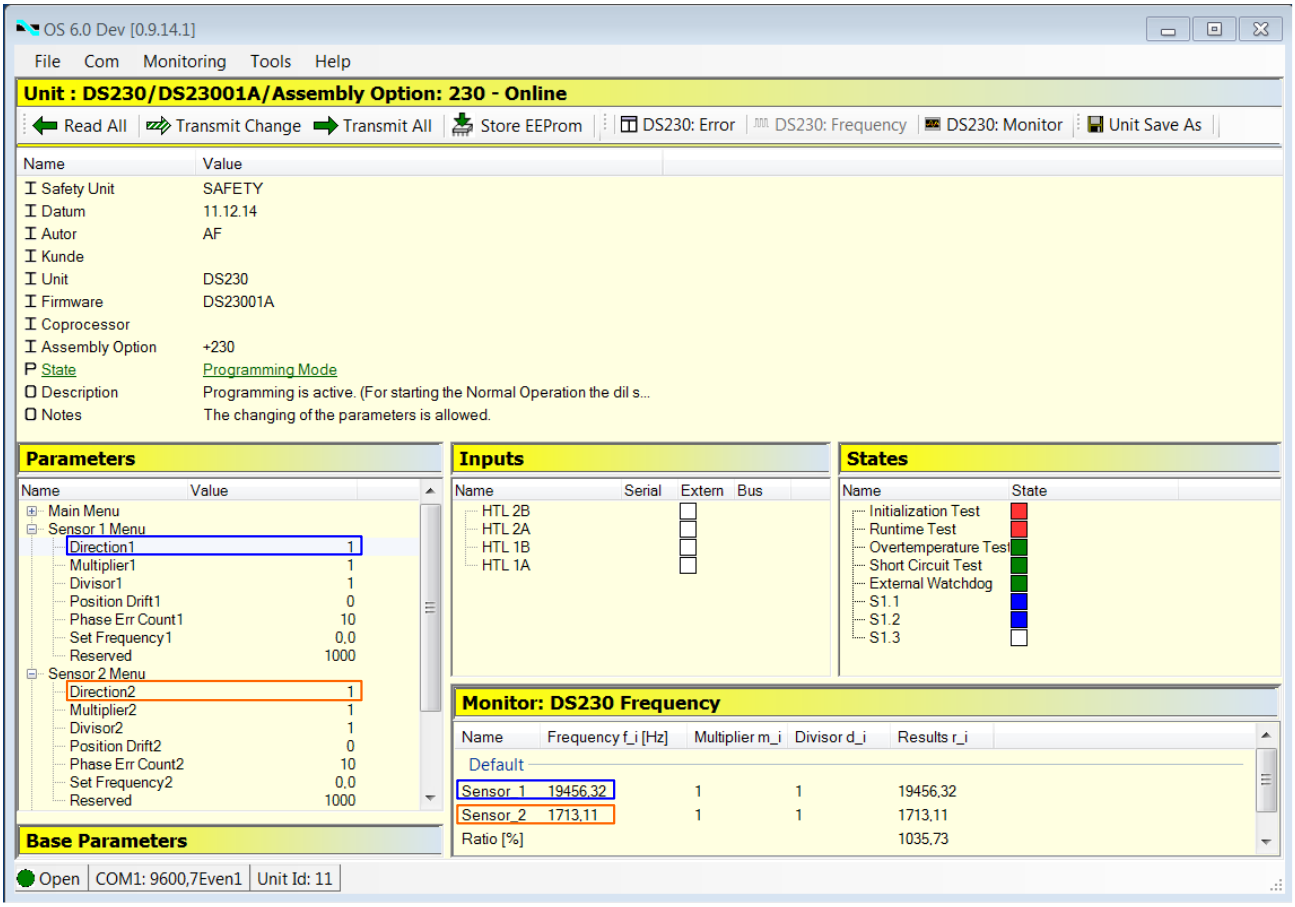
1. Does parameter 000 (Operational Mode) correspond to the selected encoder types?
2. Are correct preset values defined in the „Preselection Menu“ (parameter 027, et seq.)?
3. Are all outputs and relays adjusted in accordance to the demanded switching conditions? (see chapter …)

Optional settings:

1. Are the switching characteristics and command assignments for the HTL inputs defined?
2. Is the source input for the RS422 splitter output selected (see parameter 074)?
3. Is the analog output scaled with a start- and an end-value (see parameter 078, 079)?

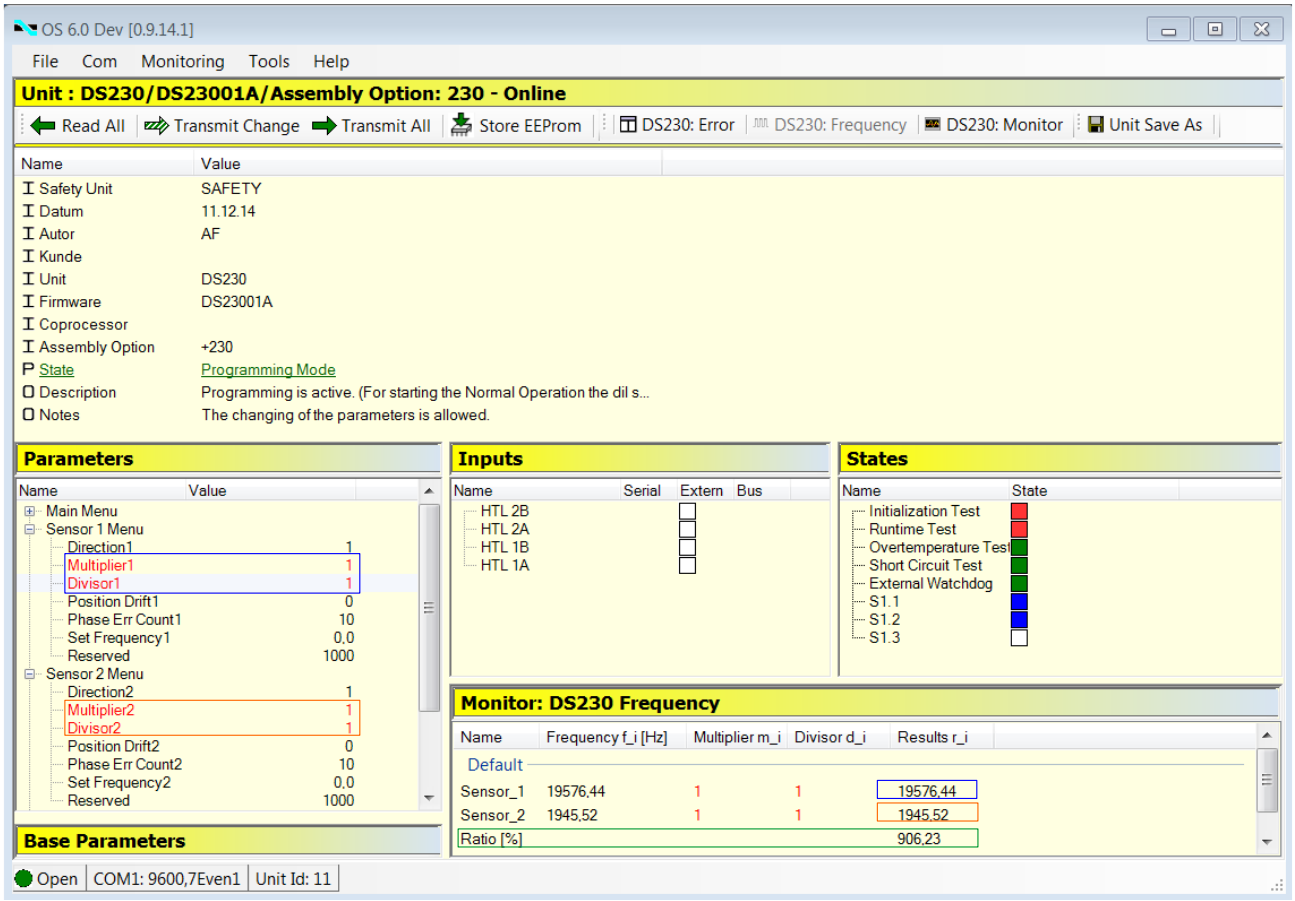
9.4. Definition of the Directions

In order to define the directions, the machine must move resp. turn to its working direction. The frequencies of sensor 1 and 2 are indicated in the “Monitor” window of the operator surface. The direction of each frequency can be changed by setting the respective „Direction“ parameter (either 0 or 1).

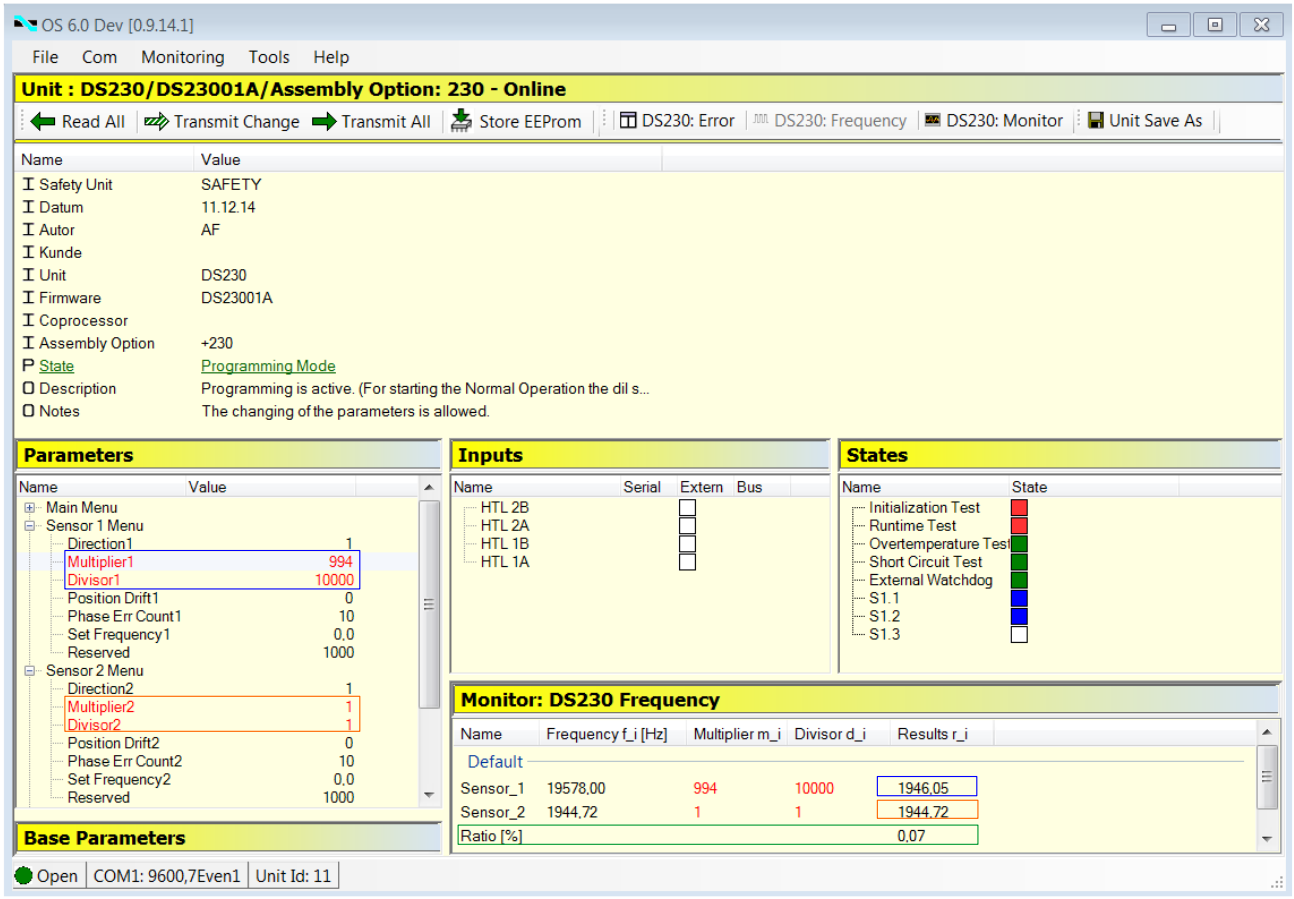


9.5. Sensor Channel Adaption

When using two sensors with a different number of pulses or in case of a mechanical speed reduction between both encoders, then the higher frequency must be adjusted to the lower one. For this calculation the scaling factors (see chapter 8.4.2) are used.



In the example above the frequency 2 is by the factor 0.0994 smaller than frequency 1.
For adjusting, the “Multiplier 1” (parameter 012) should be set to 994 and the “Divisor 1” (parameter 013) to 10.000.



By scaling the frequency 1 both internally calculated frequencies are approximately equal and the calculated ratio is close to "0".

9.6. Completion of Commissioning

Finally all application-dependent parameters should be checked for plausibility again. The digital outputs and relays can be tested for their correct behaviour by using the parameter "Output Action" from the menu "Switching Menu".

The safety-related relay output opens in case of failures or if a programmed switching condition (see chapter 8.4.4) is reached. Further the contact will be open, if the unit is in the de-energized state.

It is imperative to test the function of the relay and the evaluation in the target device finally!

- **The user of the equipment is responsible for ensuring all relevant parts of the system to a safe state, when the relay contact is open.**

After commissioning, the unit state “Operational Mode” must be left by setting the slider 3 of the DIL-switch back to its „ON“ position. For a normal operation always all 3 sliders of the DIL-switch must be set to „ON“.

- **„Programming Mode“ only for start-up**
- **Set all DIL-switch sliders to „ON“ after start-up**
- **Protect the DIL-switch sliders after start-up (e. g. by covering with an adhesive tape)**
- **Normal operation is only permitted when the yellow LED is permanently off**

10. Error Detection

In order to ensure a maximum of operational safety and reliability, the units are equipped with several and profound monitoring-functions. The monitoring allows an immediate recognition and messaging of possible failures and malfunctions.

In case of errors:

- The relay contact switches to its open (safety) condition (interruption of the safety circuit)
- The analog output (with DS236 and DS246 units) sets to 0 mA and no more current range (4 … 20 mA) is given.
- All digital outputs are set to LOW (no more inversion between Out X and /Out X)
- No more incremental signals are available at the RS422 output (Tri-State with pulldown cut off).
- The DC-offset of the SinCos output will be shifted in order o signalize an error to the target unit.

The following types of error recognition are distinguished:

- Selftest Functions of the Unit
- Runtime Tests of the Unit

Both variants are exactly described in the following two pages…

10.1. Selftest Functions of the Unit

These monitors / tests are processed automatically when switching the unit on.

Error Code		Description
H' 0000 0001	ADC Error	
H' 0000 0002	I2C Error	
H' 0000 0004	OTH Error	
H' 0000 0008	SCI Error	
H' 0000 0010	DIO Error	
H' 0000 0020	GPI Error	
H' 0000 0040	CAP Error	
H' 0000 0080	SPI Error	
H' 0000 0100	QEP Error	
H' 0000 0200	SCO Error	

10.2. Runtime Tests of the Unit

These monitors / tests are processed automatically and continuously in the background.

Error Code		Description
H' 0000 0001	SIN/COS 1 Input Error	
H' 0000 0002	SIN/COS 2 Input Error	
H' 0000 0004	EX SUP GV1 Error	
H' 0000 0008	EX SUP GV2 Error	
H' 0000 0010	EX SUP ABO Error	
H' 0000 0020	EX SUP ABO ST Error	
H' 0000 0040	EX SUP GV ST Error	
H' 0000 0080	EX SUP Short Circuit Error	
H' 0000 0100	TEMP Error	
H' 0000 0200	RB Digital Output Error	
H' 0000 0400	SEQ Analog Output Error	
H' 0000 0800	RB Relays Output Error	
H' 0000 1000	RB Analog Output Error	
H' 0000 2000	GPI Error	
H' 0000 4000	DAC Sequence Error	
H' 0000 8000	DAC Error	
H' 0001 0000	PH 1 Error	
H' 0002 0000	PH 2 Error	
H' 0004 0000	Frequency Fault	
H' 0008 0000	Drift Fault	
H' 0010 0000	REG Error	
H' 0020 0000	RTI/QEP Cycle Error	
H' 0040 0000	External Clk Test	
H' 0080 0000	Wrong Parameter Error Stimulation	
H' 0100 0000		
H' 0200 0000		
H' 0400 0000		
H' 0800 0000		
H' 1000 0000	ADC Error	
H' 2000 0000	I2C Error	
H' 4000 0000	Selftest Error	
H' 8000 0000		

10.3. Error Representation

Error Representation	Reference
Front LED's	see chapter 5.14 (LEDs / Status Indication)
Display unit BG230	see BG230 user manual
Operator surface OS6.0	see OS6.0 user manual

10.4. Error Clearing

Error states can generally be cleared by switching the power off and on again (after removing the error source).

10.5. Error Detection Time

Basically it is not possible to specify an exact error detection time because the error detection depends on many factors.

The error detection time depends (amongst other things) on the following factors:

- Input frequency
- Parameters like:
  Sampling Time, Wait Time, Divergence, Power-up Delay, Standstill Time, …
- Reaction time of the output

11. Parameter List

No.	Parameter	Min. Value	Max. Value	Default	Characters	Decimal Places	Serial Code
000	Operational Mode	0	9	0	1	0	A0
001	Sampling Time	1	9999	1	4	3	A1
002	Wait Time	10	9999	1000	4	3	A2
003	F1-F2 Selection	0	1	0	1	0	A3
004	Div. Switch %-f	0	99999	10000	5	2	A4
005	Div. %-Value	1	100	10	3	0	A5
006	Div. f-Value	0	9999	3000	4	2	A6
007	Div. Calculation	0	1	0	1	0	A7
008	Div. Filter	0	20	1	2	0	A8
009	Error Simulation	0	2	1	1	0	A9
010	Power-up Delay	1	1000	100	4	3	B0
011	Reserved	0	10000	1000	5	0	B1
012	Reserved	0	10000	1000	5	0	B2
013	Direction1	0	1	0	1	0	B3
014	Multiplier1	1	10000	1	5	0	B4
015	Divisor1	1	10000	1	5	0	B5
016	Position Drift1	0	100000	0	6	0	B6
017	Phase Err Count1	1	1000	10	4	0	B7
018	Set Frequency1	-5000000	5000000	0	87	1	B8
019	Reserved	0	10000	1000	5	0	B9
020	Direction2	0	1	0	1	0	C0
021	Multiplier2	1	10000	1	5	0	C1
022	Divisor2	1	10000	1	5	0	C2
023	Position Drift2	0	100000	0	6	0	C3
024	Phase Err Count2	1	1000	10	4	0	C4
025	Set Frequency2	-5000000	5000000	0	87	1	C5
026	Reserved	0	10000	1000	5	0	C6
027	Preselect OUT1.H	-5000000	5000000	10000	87	1	C7
028	Preselect OUT1.L	-5000000	5000000	20000	87	1	C8
029	Preselect OUT2.H	-5000000	5000000	30000	87	1	C9
030	Preselect OUT2.L	-5000000	5000000	40000	87	1	D0
031	Preselect OUT3.H	-5000000	5000000	50000	87	1	D1
032	Preselect OUT3.L	-5000000	5000000	60000	87	1	D2
033	Preselect OUT4.H	-5000000	5000000	70000	87	1	D3
034	Preselect OUT4.L	-5000000	5000000	80000	87	1	D4
035	Preselect REL1.H	-5000000	5000000	1000	87	1	D5
036	Preselect REL1.L	-5000000	5000000	2000	87	1	D6
037	Reserved	0	10000	1000	5	0	D7
038	Reserved	0	10000	1000	5	0	D8

Continuation „Parameter List“:

No.	Parameter	Min. Value	Max. Value	Default	Characters	Decimal Places	Serial Code
039	Switch Mode OUT1	0	10	0	1	0	D9
040	Switch Mode OUT2	0	10	0	1	0	E0
041	Switch Mode OUT3	0	10	0	1	0	E1
042	Switch Mode OUT4	0	10	0	1	0	E2
043	Switch Mode REL1	0	10	0	1	0	E3
044	Pulse Time OUT1	0	9999	0	4	3	E4
045	Pulse Time OUT2	0	9999	0	4	3	E5
046	Pulse Time OUT3	0	9999	0	4	3	E6
047	Pulse Time OUT4	0	9999	0	4	3	E7
048	Pulse Time REL1	0	9999	0	4	3	E8
049	Hysteresis OUT1	0	99999	0	5	0	E9
050	Hysteresis OUT2	0	99999	0	5	0	F0
051	Hysteresis OUT3	0	99999	0	5	0	F1
052	Hysteresis OUT4	0	99999	0	5	0	F2
053	Hysteresis REL1	0	99999	0	5	0	F3
054	Startup Mode	0	10	0	1	0	F4
055	Startup Output	0	31	0	2	0	F5
056	Standstill Time	0	9999	0	4	3	F6
057	Lock Output	0	31	0	2	0	F7
058	Action Output	0	31	0	2	0	F8
059	Action Polarity	0	511	0	3	0	F9
060	Reserved	0	10000	1000	5	0	G0
061	Reserved	0	10000	1000	5	0	G1
062	Input1 Function	0	10	0	1	0	G2
063	Input1 Config	0	3	0	1	0	G3
064	Input2 Function	0	10	0	1	0	G4
065	Input2 Config	0	3	0	1	0	G5
066	Reserved	0	10000	1000	5	0	G6
067	Reserved	0	10000	1000	5	0	G7
068	Serial Unit Nr.	11	99	11	2	0	90
069	Serial Baud Rate	0	10	0	2	0	91
070	Serial Format	0	9	0	1	0	92
071	Serial Page	0	11	0	2	0	~0
072	Serial Init	0	1	1	1	0	9~
073	Reserved	0	10000	1000	5	0	H0
074	RS Selector	0	1	0	1	0	H1
075	Reserved	0	10000	1000	5	0	H2
076	Reserved	0	10000	1000	5	0	H3
077	Reserved	0	10000	1000	5	0	H4

Continuation „Parameter List“:

No.	Parameter	Min. Value	Max. Value	Default	Characters	Decimal Places	Serial Code
078	Analog Start	-5000000	5000000	0	87	1	H5
079	Analog End	-5000000	5000000	100000	87	1	H6
080	Analog Gain	1	1000	100	4	0	H7
081	Analog Offset	-100	100	0	83	0	H8
082	Reserved	0	10000	1000	5	0	H9
083	Reserved	0	10000	1000	5	0	0
084	Reserved	0	10000	1000	0	0	1

12. Variable List

Page 0: GENERAL

Page	Variable	Name	Serial Code
0 (General)	0	Assembly option	0
0	1	Selftest Error	1
0	2	MLO Error Register	2
0	3	Error Status	3
0	4	Frequency 1 [10 mHz]	4
0	5	Frequency 2 [10 mHz]	5
0	6	Frequency Divergence	6
0	7	Reserved 1	7
0	8	Reserved 2	8
0	9	Max for OP-Mode	9
0	10	RTI Counter (old value)	;0
0	11	Cycle Time in us	;1
0	12	I2C Cycle Time [us]	;2
0	13	ADC Cycle Time [us]	;3
0	14	SPI Cycle Time [us]	;4
0	15	RTI to QEP Cycle Difference	;5
0	16	INT RTI Cycle Time [1/10us]	;6
0	17	INT I2C Cycle Time [1/10us]	;7
0	18	INT SCI Cycle Time [1/10us]	;8
0	19	INT QEP Cycle Time [1/10us]	;9
0	20	CRC Check Sum Low	<0
0	21	CRC Check Sum High	<1
0	22	Max for OP-Mode	<2
0	23	Error ADM Register	<3
0	24	Test Function	<4
0	25	Frequency Divergence (org)	<5
0	26	Frequency Divergence (filter)	<6
0	27	Debug Register 4	<7
0	28	Debug Register 1	<8
0	29	Debug Register 2	<9

Continuation „Variable List“:

Page 1: ADC Field 1

Page	Variable	Name	Serial Code
1 (ADC Field 1)	0	Assembly option	0
1	1	Selftest Error	1
1	2	MLO Error Register	2
1	3	Error Status	3
1	4	Frequency 1 [10 mHz]	4
1	5	Frequency 2 [10 mHz]	5
1	6	Frequency Divergence	6
1	7	Reserved 1	7
1	8	Reserved 2	8
1	9	Max for OP-Mode	9
1	10	TPSDIA 1	;0
1	11	TPSDIA 2	;1
1	12	SC_REFO 1	;2
1	13	SC_REFO 2	;3
1	14	SC_ERR1 1	;4
1	15	SC_ERR1 2	;5
1	16	SC_OK1 1	;6
1	17	SC_OK1 2	;7
1	18	ADC_PI 1	;8
1	19	ADC_PI 2	;9
1	20	SC_REFI 1	<0
1	21	SC_REFI 2	<1
1	22	OST1 1	<2
1	23	OST1 2	<3
1	24	OST2 1	<4
1	25	OST2 2	<5
1	26	SC_ERR2 1	<6
1	27	SC_ERR2 2	<7
1	28	SC_OK2 1	<8
1	29	SC_OK2 2	<9

Continuation „Variable List“:

Page 2: ADC Field 2

Page	Variable	Name	Serial Code
2 (ADC Field 2)	0	Assembly option	0
2	1	Selftest Error	1
2	2	MLO Error Register	2
2	3	Error Status	3
2	4	Frequency 1 [10 mHz]	4
2	5	Frequency 2 [10 mHz]	5
2	6	Frequency Divergence	6
2	7	Reserved 1	7
2	8	Reserved 2	8
2	9	Max for OP-Mode	9
2	10	ADC_GV1 1	;0
2	11	ADC_GV1 2	;1
2	12	ADC_GV2 1	;2
2	13	ADC_GV2 2	;3
2	14	SUP_24 1	;4
2	15	SUP_24 2	;5
2	16	ADC_TEMP 1	;6
2	17	ADC_TEMP 2	;7
2	18	ADC_PB 1	;8
2	19	ADC_PB 2	;9
2	20	ADC_IMO 1	<0
2	21	ADC_IMO 2	<1
2	22	ADC_BST 1	<2
2	23	ADC_BST 2	<3
2	24	RB_CP	<4
2	25	RB_CM	<5
2	26	RB_SM	<6
2	27	RB_SP	<7
2	28	REL_RB1	<8
2	29	REL_RB2	<9

Continuation „Variable List“:

Page 3: ADC/DAC Field 3

Page	Variable	Name	Serial Code
3 (ADC/DAC Field 3)	0	Assembly option	0
3	1	Selftest Error	1
3	2	MLO Error Register	2
3	3	Error Status	3
3	4	Frequency 1 [10 mHz]	4
3	5	Frequency 2 [10 mHz]	5
3	6	Frequency Divergence	6
3	7	Reserved 1	7
3	8	Reserved 2	8
3	9	Max for OP-Mode	9
3	10	ADC Error Register	;0
3	11	Supply Add Board	;1
3	12	Supply GV1	;2
3	13	Supply GV2	;3
3	14	Supply 24V	;4
3	15	REFO	;5
3	16	REFI	;6
3	17	BST	;7
3	18	IMO	;8
3	19	ADC Digital Input	;9
3	20	SPI Error Register	<0
3	21	DAC RB Zero Offset	<1
3	22	DAC RB Value	<2
3	23	Calculated Analog Value	<3
3	24	Static DAC Read Back Value 1	<4
3	25	Static DAC Read Back Value 2	<5
3	26	MLO Error Register	<6
3	27	DAC Status	<7
3	28	ADC Status	<8
3	29	Assembly Option 1	<9

Continuation „Variable List“:

Page 4: GPI Field

Page	Variable	Name	Serial Code
4 (GPI Field)	0	Assembly option	0
4	1	Selftest Error	1
4	2	MLO Error Register	2
4	3	Error Status	3
4	4	Frequency 1 [10 mHz]	4
4	5	Frequency 2 [10 mHz]	5
4	6	Frequency Divergence	6
4	7	Reserved 1	7
4	8	Reserved 2	8
4	9	Max for OP-Mode	9
4	10	DIL-switch	;0
4	11	DEV 1007 input	;1
4	12	DEV 0802 input	;2
4	13	Supply GV1	;3
4	14	Supply GV2	;4
4	15	Supply 24V	;5
4	16	Supply Add	;6
4	17	Error I2C	;7
4	18	TMP Sensor 1	;8
4	19	TMP Sensor 2	;9
4	20	TMP Alert 1	<0
4	21	TMP Alert 2	<1
4	22	Intern Commands	<2
4	23	Frequency 1	<3
4	24	Frequency 2	<4
4	25	Original Frequency 1	<5
4	26	Original Frequency 2	<6
4	27	Frequency Divergence	<7
4	28	Working Frequency	<8
4	29	MLO Error Register	<9

Continuation „Variable List“:

Page 5: Position 1 & 2

Page	Variable	Name	Serial Code
5 (Position 1 & 2)	0	Assembly option	0
5	1	Selftest Error	1
5	2	MLO Error Register	2
5	3	Error Status	3
5	4	Frequency 1 [10 mHz]	4
5	5	Frequency 2 [10 mHz]	5
5	6	Frequency Divergence	6
5	7	Reserved 1	7
5	8	Reserved 2	8
5	9	Max for OP-Mode	9
5	10	Position 1	;0
5	11	Position difference 1	;1
5	12	Old Time Period 1	;2
5	13	Frequency 1	;3
5	14	Position 2	;4
5	15	Position difference 2	;5
5	16	Old Time Period 2	;6
5	17	Frequency 2	;7
5	18	Drift Fault	;8
5	19	Intern Commands	;9
5	20	PHE Counter 1	<0
5	21	PHE Counter 2	<1
5	22	Time Out 1	<2
5	23	Time Out 2	<3
5	24	Drift 1	<4
5	25	Drift 2	<5
5	26	Drift Value CO1	<6
5	27	Drift Value CO2	<7
5	28	QDC Counter 1	<8
5	29	QDC Counter 2	<9

Continuation „Variable List“:

Page 6: RTI, Watchdog and CAP

Page	Variable	Name	Serial Code
6 (RTI, Watchdog, CAP)	0	Assembly option	0
6	1	Selftest Error	1
6	2	MLO Error Register	2
6	3	Error Status	3
6	4	Frequency 1 [10 mHz]	4
6	5	Frequency 2 [10 mHz]	5
6	6	Frequency Divergence	6
6	7	Reserved 1	7
6	8	Reserved 2	8
6	9	Max for OP-Mode	9
6	10	Error Other	;0
6	11	Cycle Time based on RTI, in us	;1
6	12	Watchdog Timer	;2
6	13	MLO Error Register	;3
6	14	DEV 0802 input	;4
6	15	Digital Output Setting	;5
6	16	Relay Output Setting	;6
6	17	WDO Error Register	;7
6	18	Frequency HTL A1	;8
6	19	Supervisor Frequency HTL A1	;9
6	20	Frequency HTL B1	<0
6	21	Supervisor Frequency HTL B1	<1
6	22	Frequency HTL A2	<2
6	23	Supervisor Frequency HTL A2	<3
6	24	Frequency HTL B2	<4
6	25	Supervisor Frequency HTL B2	<5
6	26	WDO Token	<6
6	27	WDO Status	<7
6	28	WDO Value	<8
6	29	Error SPI Register	<9

Continuation „Variable List“:

Page 7: Error

Page	Variable	Name	Serial Code
7 (Error)	0	Assembly option	0
7	1	Selftest Error	1
7	2	MLO Error Register	2
7	3	Error Status	3
7	4	Frequency 1 [10 mHz]	4
7	5	Frequency 2 [10 mHz]	5
7	6	Frequency Divergence	6
7	7	Reserved 1	7
7	8	Reserved 2	8
7	9	Max for OP-Mode	9
7	10	Error ADC Register	;0
7	11	Error I2C Register	;1
7	12	Error OTH Register	;2
7	13	Error SCI Register	;3
7	14	Error DIO Register	;4
7	15	Error GPI Register	;5
7	16	Error CAP Register	;6
7	17	Error SPI Register	;7
7	18	Error QEP Register	;8
7	19	Error SCO Register	;9
7	20	Error CPU Register	<0
7	21	Error RAM Register	<1
7	22	Error MLO Register	<2
7	23	Frequency Fault	<3
7	24	Drift Fault	<4
7	25	Error REG Register	<5
7	26	DIL Switch	<6
7	27	Assembly Option 1	<7
7	28	Outputs	<8
7	29	Selftest Error	<9

Continuation „Variable List“:

Page 8: Outputs

Page	Variable	Name	Serial Code
8 (Outputs)	0	Assembly option	0
8	1	Selftest Error	1
8	2	MLO Error Register	2
8	3	Error Status	3
8	4	Frequency 1 [10 mHz]	4
8	5	Frequency 2 [10 mHz]	5
8	6	Frequency Divergence	6
8	7	Reserved 1	7
8	8	Reserved 2	8
8	9	Max for OP-Mode	9
8	10	Standstill Status	;0
8	11	Time Out OUT1	;1
8	12	Time Out OUT2	;2
8	13	Time Out OUT3	;3
8	14	Time Out OUT4	;4
8	15	Time Out OUT5	;5
8	16	Pulse Status	;6
8	17	Output Status	;7
8	18	Frequency	;8
8	19	Intern Command	;9
8	20	Self hold Status	<0
8	21	Startup Status	<1
8	22	Startup Time	<2
8	23	Calculated Analog Value	<3
8	24	Working Frequency	<4
8	25	Frequency Divergence	<5
8	26	Max. Frequency Divergence PC	<6
8	27	Max. Frequency Divergence AB	<7
8	28	Frequency 1 for Divergence	<8
8	29	Frequency 2 for Divergence	<9

Continuation „Variable List“:

Page 9: USB

Page	Variable	Name	Serial Code
9 (USB)	0	Assembly option	0
9	1	Selftest Error	1
9	2	MLO Error Register	2
9	3	Error Status	3
9	4	Frequency 1 [10 mHz]	4
9	5	Frequency 2 [10 mHz]	5
9	6	Frequency Divergence	6
9	7	Reserved 1	7
9	8	Reserved 2	8
9	9	Max for OP-Mode	9
9	10	USB State	;0
9	11	USB COM Register 1	;1
9	12	USB COM Register 2	;2
9	13	USB COM Register 3	;3
9	14	USB COM Register 4	;4
9	15	USB COM Register 5	;5
9	16	USB COM Register 6	;6
9	17	Reserved	;7
9	18	Reserved	;8
9	19	USB Command disp	;9
9	20	USB Serial Code 1	<0
9	21	USB Serial Code 2	<1
9	22	USB Control	<2
9	23	USB Configuration	<3
9	24	USB Write Value	<4
9	25	USB Get Char	<5
9	26	USB Get DevStat	<6
9	27	USB Setup State	<7
9	28	USB Setup Cycle Time	<8
9	29	USB Error Register	<9

Continuation „Variable List“:

Page 10: Test

Page	Variable	Name	Serial Code
10 (Test)	0	Assembly option	0
10	1	Selftest Error	1
10	2	MLO Error Register	2
10	3	Error Status	3
10	4	Frequency 1 [10 mHz]	4
10	5	Frequency 2 [10 mHz]	5
10	6	Frequency Divergence	6
10	7	Reserved 1	7
10	8	Reserved 2	8
10	9	Max for OP-Mode	9
10	10	Variable 10	;0
10	11	Variable 11	;1
10	12	Variable 12	;2
10	13	Variable 13	;3
10	14	Variable 14	;4
10	15	Variable 15	;5
10	16	Variable 16	;6
10	17	Variable 17	;7
10	18	Variable 18	;8
10	19	Variable 19	;9
10	20	Variable 20	<0
10	21	Variable 21	<1
10	22	Variable 22	<2
10	23	Variable 23	<3
10	24	Variable 24	<4
10	25	Variable 25	<5
10	26	Variable 26	<6
10	27	Variable 27	<7
10	28	Variable 28	<8
10	29	Variable 29	<9

Continuation „Variable List“:

Page 11: Test

Page	Variable	Name	Serial Code

13. Technical Specifications

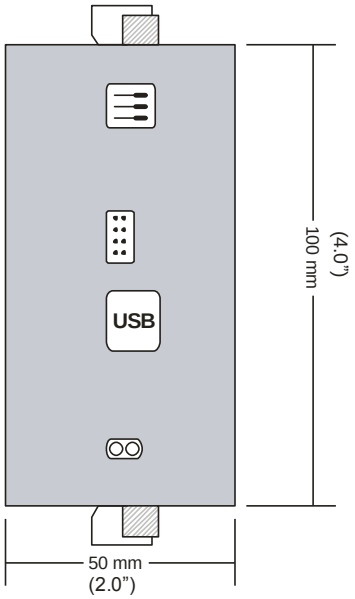
Power supply:	Input voltage:	18 ... 30 VDC with reverse polarity protection
	Ripple:	max. 10 % at 24 VDC
	Power consumption:	approx. 150 mA (unloaded)
	Protection:	external fuse (2.5 A, medium time lag) necessary
	Connections:	X3, screw terminal, 2-pin, 1.5 mm²
Encoder supply:	Output voltage:	approx. 2 VDC less the input voltage
	Output current:	max. 200 mA per encoder
	Protection:	short circuit proof
SinCos inputs:	Number of inputs:	2
	Amplitude:	0.8 ... 1.2 Vpp
	DC offset:	2.5 V ± 0.1 V
	Frequency:	max. 500 kHz
	Connections:	X6 and X7, SUB-D (male), 9-pin
Incremental inputs:	Number of inputs:	2
	Format:	RS422 standard(differential signal A, /A, B, /B)
	Frequency:	max. 500 kHz
	Connections:	X8 and X9, screw terminal, 7-pin, 1.5 mm²
Control inputs:	Number of inputs:	2 (each performs complementary)
	Application:	HTL encoders, proximity switches or control commands
	Signal level:	HTL / PNP (10 ... 30 V)
	Load:	max. 15 mA
	Frequency (HTL signals):	max. 250 kHz
	Frequency (control inputs):	max. 10 kHz
	Connections:	X10, screw terminal, 5-pin, 1.5 mm²
SinCos output:	Splitter output:	for input SinCos 1 or SinCos 2
	Amplitude:	0.8 ... 1.2 Vpp
	DC offset:	2.5 V ± 0.1 V
	Frequency:	max. 500 kHz
	Connection:	X5, SUB-D (female), 9-pin
Incremental output:	Splitter output:	SinCos 1, SinCos 2, RS422 IN 1, RS422 IN 2, HTL PNP proximity
	Format:	switch
	Frequency:	RS422 (differential signals A, /A, B, /B)
	Connections:	max. 500 kHz
		X4, screw terminal, 7-pin, 1.5 mm²
Analog output:	Current output:	4 ... 20 mA (load max. 270 Ohm)
	Resolution:	14 Bit
	Accuracy:	± 0.1 %
	Connection:	X4, screw terminal, 7-pin, 1.5 mm²
Control outputs:	Output voltage:	input voltage minus approx. 2 VDC
	Output current:	max. 30 mA per output
	Switching characteristic:	Push-Pull
	Protective circuit:	short-circuit-proof
	Connection:	X2, screw terminal, 8-pin, 1.5 mm²
Relay output:	Number of relays:	two relays in series with forced-guided contacts (NO)
	Switching capability:	5 ... 36 VDC
	Switching capacity:	5 mA ... 5 A
	Connection:	X1, screw terminal, 2-pin, 1.5 mm²

Continuation „Technical Specifications“:

USB interface:	Version:	USB 1.0
	Connection:	X12, USB-B (female)
Display:	Green LED:	„ON“
	Yellow LED:	„ERROR“
Switches:	DIL switch:	1 x 3-pin
	Marking:	S1
Conformity and standards:	MD2006/42EC	EN ISO 13849-1
		EN 61508
		EN 62061
	LV 2006/95/EC:	EN 61010-1
	EMC 2004/108/EC:	EN 61000-6-2
		EN 61000-6-3
		EN 61000-6-4
		EN 61326-3-2
	Vibration resistance:	EN 60068-2-6 (Sinus, 7 g, 10 – 200 Hz, 20 cycles)
	Shock resistance:	EN 60068-2-27 (Half sinus, 30 g, 11 ms, 3 shocks)
		EN 60068-2-27 (Half sinus, 17 g, 6 ms, 4000 shocks)
	RoHs 2011/65/EU:	EN 50581
Safety characteristic data:	Classification:	SIL3/PLe (depends on the used encoder input signals)
	System structure:	dual-channel (Cat. 3 / HFT = 1)
	PFH value:	$3{,}76 \times 10^{-8}\ h^{-1}$
	Safety functions:	equivalent ... EN61800-5-2 for SS1, SS2, SOS, SLS, SDI, SSM (depending on the used encoder input signals)
Housing:	Material:	Plastic
	Mounting:	to standard DIN rails (35 mm C-profile)
	Dimensions:	50 x 100 x 165 mm (B x H x T)
	Protection class:	IP20
	Weight:	approx. 390 g
Ambient temperature:	Operation:	-20 °C ... +55 °C (without condensation)
	Storage:	-25 °C ... +70 °C (without condensation)
Programming module BG230 (optional):	Operation:	Touch screen
	Display:	OLED-Display

13.1. Dimensions

Front:



Rear: